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PROCEEDINGS, ADDRESSES, AND DISCUSSIONS  
AT THE SANITARY CONVENTION HELD  
AT EAST SAGINAW, MICHIGAN,  
DEC. 2 AND 3, 1884.

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SUPPLEMENT TO REPORT OF THE MICHIGAN STATE BOARD OF  
HEALTH FOR 1885.

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[This report of the Convention at East Saginaw has been prepared from notes by Harriet V. Brooks, M. D., Secretary of the Convention, and by S. G. Higgins, Stenographer, and from the published account of the proceedings which appeared in the *Saginaw Courier*.]

This convention was held, in accordance with an invitation from citizens of East Saginaw, under the direction of a committee of citizens and a committee from the State Board of Health. The following named persons were the local committee: Hon. Geo. B. Brooks, *Chairman*, Dr. Harriet V. Brooks, H. P. Smith, Esq., Rev. Rowland Connor, Rev. J. T. Oxtoby, Hon. John S. Estabrook, Hon. Frank Lawrence, J. B. Peter, Esq., Rev. W. A. Masker, Mr. Henry Turner, Judge D. W. C. Gage, Prof. J. C. Jones.

The executive committee was composed of Hon. J. S. Estabrook, Rev. J. T. Oxtoby, Mr. Henry Turner, Dr. H. V. Brooks, *Secretary*.

The committee from the State Board of Health was: J. H. Kellogg, M. D., Battle Creek; Hon. C. V. Tyler, M. D., Bay City; Henry B. Baker, M. D., Lansing.

The officers of the convention were: *President*, Hon. William L. Webber, East Saginaw; *Vice Presidents*: Hon. David H. Jerome, Saginaw City; Rev. Rowland Connor, East Saginaw; Hon. Benton Hanchett, Saginaw City; Dr. H. C. Potter, East Saginaw; Hon. N. B. Bradley, Bay City; Hon. John S. Estabrook, East Saginaw; Hon. John Moore, Saginaw City; Hon. John B. Atwood, Flint; B. B. Ross, M. D., East Saginaw; Hon. J. J. Wheeler, East Saginaw; John Barter, Esq., East Saginaw; *Secretary*, Dr. H. V. Brooks.

FIRST SESSION, TUESDAY, DEC. 2, AT 2 P. M.

The convention met, as per program, in the convenient assembly room of the common council of the city.

A fair number of citizens were present at the beginning of the session, and the audience continued to increase until nearly every seat in the room was occupied. The convention was called to order by the president, Hon. Wm. L. Webber.

After an opening prayer by Rev. J. T. Oxtoby, an address of welcome was given by Hon. J. S. Estabrook, mayor of East Saginaw. He spoke as follows:

## ADDRESS OF WELCOME.

BY HON. JOHN S. ESTABROOK, MAYOR OF EAST SAGINAW.

LADIES AND GENTLEMEN OF THE CONVENTION,—Among the many benevolent institutions of the State, the establishment of none has proved wiser than that of the State Board of Health. Nothing can be of more importance than a proper sanitary education.

Thirty-five years ago the ground upon which this city stands was almost entirely covered with forest. The spot on which this building stands and this street (Genesee), now built up with costly buildings, was a low swamp. In those early days we won the reputation of attempting to build a city in a swamp. The very name of Saginaw would give a spasm of chills to those in more favored localities. But we have had an earnest, determined, enterprising people, not afraid of work nor scared at mud or other obstacles. They have overcome these obstructions. We have organized a system of sewers and drains. We now have  $14\frac{1}{2}$  miles of sewers, a good system of water-works, good walks, and good paved streets, where once was mud. In short, we have a prosperous city of nearly 30,000 people, with elegant and comfortable homes, churches and school-houses, and with commercial interests second to none in the commonwealth of Michigan.

We understand that papers and discussions are to be had upon our sewers, our wells, our water, and other matters of a sanitary nature. Notwithstanding the obstacles we have overcome, and the gain we have made, there is still much room for improvement. We invite full and free criticism. We understand the main object of these meetings is *health*. What tends to that end tends to advance the material welfare of any community that will adopt the required improvements. It is not my purpose to address you on these subjects. That is left to abler hands. We do not claim perfection; we have risen from the reputation of an unhealthy city to the distinction of being one of the most healthy in the State. We are proud of our success. I am glad that it has fallen to my lot to welcome you to our city, and in the name of its people I welcome you. We thank you for selecting our city as the place to hold this convention. We are glad to see you, and hope your meeting will be both pleasant and profitable.

Mr. Webber announced that the chair had decided to omit the second exercise on the program, namely, an address by the president, and the convention would therefore listen to the first paper, on the subject of Ventilation, by Dr. C. H. Sample.

## VENTILATION.

BY C. H. SAMPLE, M. D., OF EAST SAGINAW.

LADIES AND GENTLEMEN—Most writers upon the subject of sanitary science, I notice, preface what they have to say by informing their readers or hearers that they do not intend to present anything original. In this instance I shall be no exception to the rule. When the secretary of this convention informed me by letter, a few weeks ago, that I would be expected to read a paper on ventilation, I did not recover from the shock until a second letter informed me that I had not accepted the invitation. Dr. Baker relieved my mind somewhat by informing me by letter that the library of the State Board of Health

contained about 4,000 books and pamphlets relating to the subject of sanitary science. He kindly sent me a few books and pamphlets, some of which I have read. If some gentlemen present should recognize theories or sentences of their own construction they need not be surprised. I shall try to present this afternoon only a few of the practical points of ventilation, and leave the discussion of finer points to more competent hands.

Accumulated filth and decomposing animal and vegetable matter has always been offensive to the nostrils of civilized man. Bad odors have been regarded as detrimental to good health.

Clear, sparkling, odorless water has always been highly prized by man, and measures have been taken for a liberal supply of good water.

The subject of ventilation is what might be called the younger branch of sanitary science. Very little attention, so far as we know, was given to the subject of ventilation prior to the year 1723, when an attempt was made at scientific ventilation. Doors and windows were thought to be quite sufficient for the purposes of ventilation a few years ago. The large open fire-place, loosely fitting doors and windows, and porous walls of the houses of years ago, gave an abundant supply of air. Now we are living in air-tight houses, with papered walls, heavily carpeted floors, closely stopped windows and doors, making appliances for the introduction of pure air into our houses a necessity. When it becomes fixed in the minds of men that a very large proportion of preventable disease can be traced directly or indirectly to the effects of bad air, the subject of ventilation will receive the attention that its importance demands. Perfect drainage and cleanly surroundings are absolutely necessary conditions for obtaining pure air. Air loaded with the germs of disease from bad drainage goes directly to the individual, and when he becomes sufficiently saturated with the poison he sickens and dies. Again, if the air be perfectly pure and the supply insufficient, the individual is compelled to breathe over and again his own exhalations. He becomes weak, and the debilitating effect makes him an easy prey to any disease with which he may come in contact. It is well known that we may abstain from food for a time, if it is found objectionable. We can do without water for a shorter time, but air we must have, and we are obliged to breathe it as we find it. It will not be necessary for me to occupy time by giving the chemical composition of pure air, neither is it necessary to say what changes occur in its composition after it has been breathed over and again by several people in a close room. It will be sufficient to say that each individual consumes about 400 cubic feet of air in 24 hours by respiration alone, that expiration and other contaminating influences make necessary an introduction of about 3,000 cubic feet of pure air per hour for each individual.

Ventilation is then only a process of diluting a confined foul air by the introduction of pure air. This is at present accomplished in two ways known as mechanical ventilation and thermal ventilation. By the former method air is either blown into a room or pumped out of the room by some mechanical device.

The latter method known as thermal ventilation is now the only practicable method for ventilating ordinary dwellings. By this method the warming and ventilation of dwellings must necessarily be considered together. By far the larger number of dwellings are heated by stoves, others by furnaces located in cellars, and a few by steam. The stove supplies most of its warmth by radiation and, consequently, heat is unequally distributed about the room. A pipe leading from the outside of the house into a jacket open at the top, surmounting the stove, furnishes a larger and better distributed amount of pure warmed

air. Open grates are constructed in a similar manner, and for warming and ventilating rooms of moderate size seem to be about the most desirable of all forms of supplying warmed air and removing cold, foul air. Heating by steam radiators located in the center or sides of a room, with no provision for the introduction of pure air nor for the removal of foul air, seem to be the most undesirable and unscientific of all forms of warming apparatus. Coils of steam pipes or furnaces in basements with a good supply of fresh air passing around them, and this fresh warmed air conveyed by pipes to different parts of the building, with large registers in the floors, seems at present to be the best means of warming our houses. This warmed air upon entering the room rises to the ceiling and in coming in contact with the ceiling and walls of the room becomes cooled and falls to the floor. It has been found that the chemical composition of air does not materially differ when taken from different parts of a room; whether it be at the floor or the ceiling it contains about the same quantity and kinds of impurities. Foul air, then, should be taken from the floor instead of the ceiling, for we then remove the cold air that accumulates at the floor, and preserve a more equable temperature in all parts of the room. To prevent drafts the apertures for the exit of foul air should be located at the floor level, in the floor, and upon all sides of the room. These must communicate fully with a warmed ventilating shaft. A chimney, surrounding the smoke-pipe of the furnace, located as near the center of the building as possible, seems to supply the best form of ventilating shaft. By whatever means we are to ventilate a room, as large a space should be given for the exit of foul air as is given for the entrance of pure air.

For a more accurate description of the best means of ventilation I shall ask you to listen to the reading of a paper by Mr. Johnson, upon that subject. I have made an effort to call attention to the subject and to a few of its more prominent features.

With the presence of Asiatic cholera in Europe, and the great probability that it will soon visit us, now seems to be a time when the public mind should more than ever be concerned about the sanitary condition of our cities.

Following this was read a paper by Wm. W. Johnson, on the same subject.

## VENTILATION.

BY WILLIAM W. JOHNSON, ARCHITECT.

The open fire-place is, in the minds of most people, the ideal ventilator, and there is no doubt but that every man who has not one wants one, while he who possesses such a luxury is quite satisfied with its results and imagines that the atmosphere he breathes is in the highest condition of purity. Then, the fire in the grate is a pleasant thing to dream over, and, as we grow imaginative, the live coals become live people, or animals, assuming any shape or form the dreamer may desire. The grate fire is an agreeable companion, especially in early fall or late spring, when we want to "take the chill off" the room; but when cold weather really comes we find its heat inadequate to our comfort, so we allow the fire to die out and open the registers ("those cheerful holes in the floor") and allow fresh, roasted air delivered to us from our pot furnace in the basement, to circulate through the house. Sometimes the furnace seems to fail to warm the cold air brought to it from out of doors through the cold-air duct, and the idea occurs to us of closing the valve in this duct and

taking our fresh air (?) from the cellar. This is an improvement, and we save fuel too, because the warmer air in the building can be brought to the required temperature much easier than the "dreadfully cold" outside atmosphere. This little operation is called "revolving the air." Revolving the air of a dwelling house is an unwise thing to do. The air becomes more unwholesome at every breath, rendering the brain and body dull and stupid, and, without doubt, susceptible to various forms of disease. Now, the ordinary grate fire-place consumes enough and much more than enough fuel to keep an apartment thoroughly warmed in the coldest weather, but so entirely wrong is the principle of its operation that it hardly does more than to draw to it large quantities of air through every crevice and aperture in the outside walls of the house, using what is necessary for the combustion of its fuel and sending the remainder with the smoke and cinders up the chimney. The fresh air thus drawn into the room, being colder than the air already contained there, at once drops to the floor, then moves towards the fire, so that while there are lively draughts of fresh air disporting themselves around our lower extremities, the upper strata are comparatively sluggish and impure. We imagine when we hear the roaring of the fire in the grate that we are getting perfect ventilation, while in fact the fresh air coming into the apartment seldom gets higher than a few inches above the floor, and the very air that is rushing up the chimney flue is the invigorating oxygen that ought to be in better use.\* Could the nature of things be slightly reversed and the occupants of the house walk upon the ceilings, with their heads near the floor, the fire-place might be considered a great success, except, perhaps, by bald headed gentlemen who might be susceptible to colds in the head, but they could wear their hats.

Many able minds have contributed to the literature of ventilation, and a vast amount of such literature can be obtained from the library of the Michigan State Board of Health. Therefore, I will not take much of the valuable time of the convention in this essay.

Few public buildings of any size or importance are built now-a-days that are not designed with considerable reference to the heating and ventilating of the same. For some strange reason, however, most dwelling houses and even large commercial buildings are constructed without the slightest thought or care given to the heating of them as far as the relation of heating to ventilation is concerned. But as methods are being introduced whereby a fair degree of ventilation can be secured and at the same time the building, or apartment, can be thoroughly warmed at less cost in fuel than heating without ventilation, the time cannot be far distant when the ventilating stove, or grate, or furnace, will be in general use as an economical means of warming buildings.

It is strange with what indifference we look upon the advantages of pure air, especially when the introduction of it into houses implies the cost of an extra flue or two in the chimney, or the very slight extra cost of properly constructed heating appliances. All who have given the subject of heating and ventilating any study know that there are two popular methods of supplying the interior of buildings with pure air, viz.: the "natural" and the "mechanical." The natural method implies a system of circulation, caused entirely by the difference in the specific gravities of the incoming fresh warm air from

\*[If a capacious fresh-air inlet is provided, and the air warmed before it enters the room, the unpleasant drafts of cold air are prevented, and the fire-place is then a very pleasant and efficient ventilator. This can be done by a fresh-air duct under the floor and up one side or behind the fireplace where an air-tight iron pipe entering the chimney immediately over the fire, conveys the warmed fresh air out into the room, near the ceiling, directly over the fireplace. See last paragraph on page 7.—H. B. B., Sec. State Board of Health.]

the heater and the air already in the room, which, becoming more or less chilled by contact with the surfaces of the ceiling, walls, and windows, has condensed and fallen to the lower part of the room, the constant pressure of the warmer strata above forcing this colder and vitiated air out of the apartment through outlets provided at the floor level, ultimately connected with a warm flue or shaft and discharging above the roof. The earlier attempts at this system generally resulted in failures, the furnace being unable to heat the large volume of cold air passed over it. Often the air would be found entering the room through the very ducts intended to carry it off. The cold air would enter the house by means of the flue in the chimney which was intended to have an upward draft. The mechanical method necessitates machinery (a powerful fan, blower, or pump) to force the air into the furnaces and from thence through the building. There can be no doubt that the perfect application of the "mechanical" system is the most effective means of heating and ventilating a building, but in ordinary cases it is costly beyond all hope of its ever being applied. An evenly distributed supply of fresh, warmed air admitted to an apartment through a perforated floor cannot fail to give the occupant, wherever he may be, a constant quantity of pure air, but as the movement of this air is directly upward it follows that the breather of it must always be just over its entrance, so that the best results can only be obtained by perforating the entire area of the floor and so provide for a crowded room or for the necessary change of location of one or more occupants. The Houses of Parliament in London are warmed and ventilated in this way very successfully.

Once I heard the Bishop of Colorado, in a lecture, say that when visiting the House of Commons his guide conducted him through the elaborate basements, and, arriving at a certain point, said that they were right under the floor of the House. The ceiling was very low and the man pointed upward and told the bishop that Mr. Gladstone was addressing the House, and if he would put his hand "up there" he could touch the sole of the great man's boot through the floor. The bishop of course availed himself of the honor. He did not explain, however, how it was possible for him to put his hand through a floor, but I have since learned that the floors of both Houses are made of coarse wire netting resting on strong bands and beams of iron. The netting is covered with a very coarse carpet which allows the incoming air to sift through from below after being warmed or cooled, as the season may demand. The air rises at once to the ceiling, which is full of openings, passes into the open space above, thence to a large chimney or shaft at the bottom of which a huge fire is constantly kept burning, the heat of which accelerates the upward draft. The chief engineer has a staff of about fifty men constantly employed about the buildings, and so carefully is the temperature watched that there is seldom more than 1° F. variation. The cost of running this elaborate system must be enormous, but the air within the building is kept as pure as that without, by actual test. It is impossible to re-breathe any of this air, for as soon as exhaled from the lungs it moves upward with the general current and the pure air from below takes its place.

I do not think that absolute ventilation is possible with the "natural" method, because the air circulates, or rather moves, in at least three directions: first, upward to the ceiling, then outward to the adjacent wall, and thence to the exits at the floor level. Persons might be close to the inlet duct, inhaling and vitiating the air just as it entered the room, while others near the windows, where the air chills the most rapidly, would necessarily breathe this

air already vitiated by exhalations from the lungs. Then, too, if the air of the room at the level of our heads be at a temperature of  $70^{\circ}$ , would not the exhaled breath from our lungs, being at a temperature of  $90^{\circ}$  F., even weighted with all its impurities and gases, rise above this lower air at the temperature of  $70^{\circ}$  F., and become intermingled with the air at the top of the room, descend again, and be re-breathed, only, of course, in a greatly diluted form? But although this "natural" method of ventilation cannot as yet be called absolutely complete, it is practically so, and we need never fear of its good results. It sends large volumes of sweet air into our rooms, and its circulation is so complete that whatever part of the room we may be in we are sure to receive a portion of its wholesome atmosphere. So let us adopt this "natural" ventilation because it is the most practicable system known, and because we can by that means warm our rooms by "circulation" instead of by "radiation," and thus save fuel. He who prefers good air to the nickel-plate beauty of the modern stove, can, by expending a few dollars, secure very fair ventilation by enclosing a portion of the stove with a sheet-iron case or jacket, allowing a space of perhaps three inches between stove and jacket for an abundance of pure air (taken from the outside of the house through a wooden duct under the floor) to pass through and be warmed before entering the room. If an exit flue is provided, a complete circulation of this warmed fresh air can be obtained and enough air necessary for the combustion of the fuel can be furnished without drawing it from the outside through cracks and crevices.

This, in itself, would keep out of the room about 4,000 cubic feet of outside air for each twenty-five lbs. of coal consumed. I have already spoken of how the air necessary for the combustion of the fuel always moves from the point of entrance into the room to the fire, close along the floor, it being the coldest and consequently the heaviest air in the room. But we ought not to be obliged to cover up the ornate designs in flowers and foliage displayed on the exterior of the stove, with a sheet-iron cylinder of ugly proportions. The public should demand a ventilating stove and the manufacturers would not be slow to respond to their cry. "Shining Lights," "Crown Jewels," and "Garlands" would soon change shape, and the stove proper would become an ugly cylinder of cast iron covered with an ornamental shell of iron work, a "dress coat" some one has called it. The patented grate of Jackson Bros., of New York city, is an invention worthy of much praise. Here is an article which does not need to be put away, as it were, in the coldest weather. This grate ventilates and warms the apartment thoroughly, and with less fuel than the ordinary grate. It is the principle of "circulation" again. It does not draw cold air into the room from the imperfections of carpentry. It rather invites the fresh cold air to it, warms it, delivers it to the apartment, urges it to every nook and corner, then takes it back to itself, consumes it, and sends it off up the chimney into the outside atmosphere. The Jackson grate is kind and generous. It does not consume the air until the breathers in the room have enjoyed it and discarded it. Its cost is but little more than the ordinary apparatus, while probably the saving in fuel would twice in one season pay the difference of cost. The Ruttan furnace, or air warmer, as it might properly be called, is by far the most successful heater and ventilator for public buildings at present in the market. It furnishes large volumes of fresh, warmed (not roasted) air to the rooms, and at but little more than one-half the expense for fuel required for the ordinary "pot" furnace. No weather seems to be too cold for its complete operation, both as to heating and ventilating. The windows never need to be opened when the apartment

becomes too warm. A simple movement of a valve closes the warm-air opening at the furnace chamber and opens the fresh cold-air opening, thus changing the temperature of the room in a very few moments, at the same time continuing the admission of fresh air. This valve is operated from the room above and is so arranged that it is impossible to shut out the fresh current of air from the apartment. The Hoyt school of this city uses this very successful furnace. The janitor tells me that within two hours of the time of lighting the fires, all the rooms in the building are heated to a temperature of 70° F. The makers of this apparatus have, after a long series of experiments, succeeded in obtaining a furnace of great power, warming the air just as the locomotive boiler heats the water.

The movement of air under ordinary conditions is so simple and natural that all ought to understand it and become interested in it. If people could be made to believe that cheap and thorough heating is possible with ventilation, then pure air would be held in greater esteem than it now is; and why should it not be prized as much as pure water, or wholesome food? Mr. Carl Pfeiffer, of New York, says that "sanitary architecture is a matter of transcendent importance to the human race. Vitiating atmosphere is quite as injurious and stupefying as the worst alcoholic drinks; it spoils every dinner, it kills sleep, it is the greatest enemy of the preacher in that it makes people drowsy and puts them to sleep; it disarranges the whole natural organism. The judge and jury in a court room filled with pestilential air are as much under the influence of a deadly narcotic as the inhalers of opium smoke. The poorer classes of our large cities suffer probably most from this breathing of polluted atmosphere. It is well to preach temperance, but is it not well and of preëminent necessity to preach and procure clean, pure air and healthy sunlight? Is it not worse than folly to refuse the cup from which your friend has drunk, and at the same time breathe into the inmost recesses of your body the air from the lungs of a promiscuous crowd, whether in rooms, halls, churches, or street or railroad cars, or from a pestilential neighborhood? When we contemplate the almost universal fear of draft, that is to say fresh air, which pervades almost all classes of modern society, and from the effects of which little children are made to suffer even more than the adult generation, it seems that nothing could be more timely than a crusade against this carbonic acid intoxication to which men seem so hopelessly given; for this breathing of foul air is nothing but an intoxication accompanied by all its evil effects, want of appetite, headache, loss of sleep, etc., and the cause of most of those diseases which are foolishly ascribed to pure air under the name of drafts." In the above quotation it is hardly possible that Mr. Pfeiffer would have it understood that a draft of air, in the ordinary sense of the term, is not without its evil effects, but rather that the admission of pure air into the room, even with the most imperceptible currents, is not acceptable to the class of persons to whom he refers.

Dr. Kedzie has written of the air of railway cars in winter weather. He says that once on a winter night he rode from Detroit to Ypsilanti in a crowded car and that the air became so foul that the candles "burned blue," and two of them went out entirely, but whenever the doors at the ends of the car were opened and fresh air was admitted the candles would burn up brightly only to relapse into the "blues" again shortly after the doors were closed. Think of those sixty or more passengers breathing and re-breathing such polluted atmosphere. So foul that a candle could not burn in it. Another writer on the subject of car ventilation says that "an ordinary railway carriage

contains something over 3,000 cubic feet of air. Supposing there be sixty passengers inside of the vehicle, and that by the lungs and the cutaneous and other transpiration each one contaminates ten cubic feet of this air every minute, it is evident that in about five minutes the whole body of air within the car has been contaminated. We can form some estimate, therefore, of the intensity or concentration of this contamination when at the end of a winter's night, of say fifteen hours, the whole body has been rendered filthy five times an hour—seventy-five times during the night. It is useless to point to the 'ventilators' through the roof of the car, for not a particle of air can go out of *them* for the whole fifteen hours, except a little puff at the opening of a door, for no air can leave an air-tight compartment unless that same quantity be let into it, and we all know from experience that none of the windows will be allowed to be opened during a winter's night.

"The lungs of every adult person take in a pint of air at every breath, and this about twenty times a minute, so that into this small, tight box of a carriage there are poured twelve hundred pints of matter every minute, the reeking contents of the lungs and stomachs of these sixty passengers, some of them consumptives and many others mayhap redolent of brandy and tobacco. It is quite bad enough for a person to take in a second time the effluvia of his own lungs and stomach, but how exceedingly disgusting is the idea of taking in the emanations not only of the stomach and lungs but of other parts of the body of so promiscuous a crowd, for the space of fifteen hours, the matter becoming more and more putrid every minute. Is it not a wonderful provision of nature that life can be sustained under such circumstances? And is it not beyond all comprehension that an intelligent community quietly submits to and tolerates such a state of things? Now couple this with the suffering endured from cold feet, which rest all night upon an ice-cold floor, while the head is in a bath of human filth nearly up to blood heat." It seems unjust to criticize the ventilation of cars until a successful method has been invented of doing the work. To furnish pure, warm air for sixty people implies a large furnace and one of great power. The space required for such an apparatus would be necessarily very great and seating capacity would have to be reduced or the vehicle made larger at increased cost. If a practical plan could be offered whereby the entire body of air within the car could be completely changed every five minutes and at the same time every part of the carriage kept thoroughly warmed, the railroad companies would doubtless adopt it without delay.

The problem is a difficult one and has not yet been solved.

The discussion was opened by Prof. R. C. Kedzie, of Lansing. He remarked that the subject of ventilation was well illustrated in the room occupied by the convention, where the ventilators had all gone to roost, being placed near the ceiling, exactly where they should not be—unless it were desired to get rid of the cream of the atmosphere and keep the skim-milk for the uses of respiration. The room also illustrated the fact that nearly everything in nature breathed, that is, allowed air and dust to pass more or less through its substance. The outlines of joists, lath, etc. plainly discernable in the ceiling in spite of repeated calcimining, proved that the plaster allowed dust to pass through it while the lath and joists arrested a portion of it. With the proper apparatus he could blow through a four-inch brick wall. If it were not for the fact that the walls of this room breathed, if the common council had depended upon the ventilators for air, it would have been dissolved long ere this by an injunction from the other world. For proper ventilation openings must be made near the floor, which was the only place where pure air could be brought in and foul air taken out. He had been called to inspect the old Rutan system of ventilation in a school building supposed to be correctly constructed. He found that a cloud of smoke hung suspended in the middle of the room, showing no tendency to seek the shaft: a silk handkerchief

held in front of the ventilator swayed sometimes toward and sometimes from it, proving that there was no decided current in the direction of the shaft. The trouble he considered to be that the system was too complicated, too many openings were made into one shaft and the air lost its way.

Being asked how fresh air should be brought into a room, Dr. Kedzie replied that it should be first warmed and then introduced in such a way that no occupant of the room should feel a draft. Some people seemed to think it weak minded to be afraid of drafts, but this was a mistake. It had been said that the difference between poor ventilation and drafts was that the former was death by slow suffocation, the latter death by stabbing. A man sitting in front of a key hole and allowing cold air to blow on the back of his neck might have his life blown out. He thought it a good plan to surround the stove with a jacket extending down to the floor. Inside of this fresh air was allowed to enter and flow out warmed over the top.

Prof. J. C. Jones inquired if Dr. Kedzie had investigated the new Ruttan system of ventilation, and described the system and its workings in the new Hoyt school building where it was entirely satisfactory, a dense smoke being completely dissipated within fifteen minutes.

Dr. Kedzie replied that he had not examined the system within a few years, but if it were on the principle of taking the cold air out at the floor, it was a common sense system.

He spoke of the tendency of air to fall, on cooling, to the bottom of the room, alluded to the disadvantage of having the feet always in a lake of cold air while the head was in a much higher temperature, and to the danger to which children were exposed in sitting or even running about on a floor where the air was many degrees colder than that in the higher zone occupied by adults.

Dr. Ross asked to what extent air was de-oxygenated in passing over red-hot iron and whether it was thus rendered unfit for breathing. Dr. Kedzie replied that the danger was not in the air losing its oxygen, but that if it contained organic matter, poisonous products might be formed.

He thought it better to introduce a large amount of moderately heated air than a small amount of air at a very high temperature.

Mr. Webber asked if air containing some moisture was not more healthy than when entirely dry, and mentioned his own experience with a hot air furnace. By advice of Prof. Douglas, of Ann Arbor, he placed a reservoir of water under each register and found that about six quarts of water were evaporated in twenty-four hours, with the effect of greatly improving the quality of the air. Dr. Kedzie said that heated air still contained moisture though in an insensible form and that the supplying of the relative deficiency was very important. One means of doing this was to introduce a jet of steam into the room.

Rev. Rowland Connor requested that as Dr. Kedzie had been answering easy questions all the afternoon, he should now answer a hard one, namely, how he would ventilate the room then occupied, supposing the heating arrangement to remain unchanged? Dr. Kedzie scanned the ceiling meditatively for a instant and replied: "I think I would try a little dynamite."

The convention then adjourned until evening.

## PATENT MEDICINES.

BY REV. ROWLAND CONNOR, OF EAST SAGINAW.

The nostrums or proprietary compounds generally known as patent medicines are peculiarly a modern fabrication. Forty years ago they were scarcely known at all in this country, although the European origin of some of them must be put farther back. Within the last twenty or thirty years, however, their manufacture has assumed immense proportions, and the trade in them is one of extraordinary activity. In 1874, Dr. R. W. Murphy estimated the money expended for patent medicines, during the previous year, at eighty millions of dollars, in this country alone, ten millions being spent in advertising them. These figures, of course, must be greatly increased for the present time—ten years later. A gentleman interested in the sale of a single patent medicine informed me recently that the advertising bill of his house for the previous six months was \$250,000. At one time the same firm kept an advertisement standing in every daily and weekly newspaper published in the United States, but the sale of their medicine has consequently been increased so enormously that they do not now advertise so widely. One manufacturer alone pays the government \$120,000 annually for stamps upon his packages. He

sells, at retail prices, three millions of dollars worth of his medicine annually, and upon this amount he admits a profit of \$1,000,000. In one of our own daily papers I counted recently one hundred and sixteen advertisements, omitting "wants" and professional cards. Of these, twenty-eight were advertisements of patent medicines, leaving only eighty-eight to all other kinds of business. In other words, one-fourth of the entire advertising patronage of the paper came from the owners of patent medicines. In another and larger newspaper, out of twenty-one columns of advertisements no less than nine and one-half columns were devoted exclusively to patent medicines. Moreover, wholesale houses have been recently established which deal almost solely in this same line of goods. One house alone sells no less than fifteen hundred different kinds of favorite nostrums. And these few facts taken from the trade in our own country may be paralleled by similar facts from the same trade in England, Germany, France, and other European countries.

I do not need further to illustrate or attempt to confirm the statement that the patent medicine business is now of great moneyed importance. But of far more importance than the amount of money involved is the fact that it is a business which directly effects the physical welfare of human beings. All of these compounds, whatsoever their nature, are intended in some way to effect the growth of some of the tissues of the human body. Under whatever name they may be advertised—as lotions, or balms, or ointments, for external application, or as pills, powders, syrups, tonics, and tinctures for internal use—they are intended to produce a very decided and very important effect upon our bodies. They are taken for the express purpose of altering that delicate machinery of nerves, muscles, and vessels, the harmonious adjustment of which alone constitutes healthy life. The millions of dollars expended in the purchase of patent medicines represent millions of pounds or pints of solid or liquid matter taken into the system at the very moment when the most intricate, most delicate, and most precious machine of which we have any positive knowledge in the whole universe is temporarily clogged, or otherwise disarranged or broken down, and the medicine is taken in order to effect repair. Reasoning from the simplest principles of business, therefore, the natural supposition would be that every man who values his body would proceed to the taking of any medicine only with grave caution; that he would open his mouth to no powder or potion except from some very decided personal knowledge of its nature and probable effects, or some equally decided confidence in the intelligence and integrity of the one who advised him to make trial of its virtues. The extent to which patent medicines and their proprietors respond to these requirements I will now proceed to illustrate.

In the first place, in purchasing and using a patent medicine, you nearly always take a leap into the dark, that is, you know absolutely nothing of the intelligence or integrity or responsibility of the manufacturer. You have perhaps the label on the package and the printed circular or the newspaper advertisement to guide you, and that, as a rule, is all you have. You select, we will suppose, Dr. Ox's cough medicine; but who is Dr. Ox? or of what is his medicine composed? Or you decide to make trial of Mrs. Pinkham's Remedy, but you know nothing of Mrs. Pinkham, of her education or character, or of the materials with which she fills her bottles. Or, the baby is ailing, and you buy Mrs. Winslow's Syrup, but whether Mrs. Winslow is nurse or doctor, whether she is married or single, whether "she" is male or female, you do not know. Or, you turn to a Golden Medical Discovery, but who made the

"discovery"? or, why is it "golden"? or, how do you know that there was any "discovery," connected with its origin?

Many patent medicines are advertised as "Chinese," but what presumption can there be in favor of a remedy borrowed from a people which, whatever their skill in some things, are confessedly very far indeed behind all European nations in their knowledge of the healing art? Many others, again, are said to be of "Indian" origin, but where, except in penny-a-line novels, is there any evidence of the Indians possessing any knowledge of medicine unknown to our own medical fraternity? Their "medicine-men" never got beyond howling and dancing and sucking and exorcising, and were arrant knaves withal. That the "noble red man" should be made to figure so frequently as the originator of a patent medicine is a sad commentary on the superior intelligence of his white brother. The Indian is having a full revenge upon his conqueror. The remnants of the red race might dance with glee if they had sense enough to reflect upon the amount of suffering that their supposed remedies are inflicting upon the pale-faces.

Not a few patent medicines are asserted to be positively harmless because made only from roots and herbs. But from what roots or from what herbs? And why are they certainly innocuous because made only from roots and herbs? A certain elderly clergyman is said to have given the following advice to a young minister upon his ordination: "Remember, my dear brother, that you can never presume too much upon the ignorance of your congregation." Patent medicine makers seem frequently to act upon a similar suggestion, and to presume that those whom they address are ignorant of the fact that two of the most deadly poisons known, strychnine and prussic acid, are the products of "roots and herbs." But perhaps the medicine makers are correct in their presumption.

In further illustration of the reliability of nostrum compounders, I give three facts as samples of many more. A Yankee tin-peddler, with his cart, was selling goods some years ago in the country towns of New England. He happened to have with him some old bottles of medicine, and, to his surprise, found for them a ready sale. This was a sufficient hint for Yankee shrewdness. He fixed up a preparation of his own, printed a label which declared it a specific for certain diseases, and disposed of many bottles at a handsome profit. I need not give the details of his rise in the social scale, but he is now the well known Dr. F., the wealthy proprietor of one of the most widely sold patent medicines in the United States.

Some years ago a lazy and inefficient cook was discharged from a California mining camp. Proceeding to San Francisco he concocted a "bitters" by mixing aloes with bad whisky. His "bitters," ingeniously advertised, happened to "take" with the gullible public, and another man rose to fame and fortune, and now writes Doctor in front of his name, although, like the graduate of the peddler's cart, he refrains from writing M. D. after it.

In a handsome and elegantly furnished house, near the Fifth avenue in New York City, lives a very good looking and pleasant young man, who is the real owner of the most renowned soothing syrup for children ever produced. He inherited the business from his father, and the elderly Mrs. W., under whose name their nostrum is advertised, has no real existence.

The above facts might readily be paralleled with many more of the same sort. They are given as typical examples of the inner histories of many of our most famous patent medicines.

In the second place, patent medicines, as a rule, are not what they pretend to be. In proof of this statement I give the analysis of a number of patent medicines, borrowing most of them from a valuable paper by Dr. A. B. Prescott, of the University of Michigan.

Some years ago a "Chinese" doctor traveled through Michigan in a car drawn by four horses, and having with him a band of music and a lecturer. He sold a pain-killer, said to be the result of profound study in China. His pain-killer was analyzed and found to consist of spirits of camphor, spirits of lavender, ammonia, oil of sassafras, and alcohol.

Another pain-killer, known as "Nature's Own Cure," advertised as a sure relief for 166 different diseases, consists of red pepper, ammonia, and alcohol.

"Fragrant Pain Curer" is ether, glycerine, common salt, and water.

"Golden Wonder, or Seven Seals" is ether, chloroform, camphor, peppermint oil, red pepper, and alcohol.

A New York "Elixir of life" is aloes, cinnamon, sweet flag, angelica root, saffron, burnt sugar, glycerine, and alcohol.

A "Salt of Life" is baking soda, common table salt, Glauber's salts, and sugar, flavored with cinnamon, cardamom, orange peel, and violet root. This mixture, which is intended to be used constantly at meals, is sold for twenty-five cents a pound.

Another "Elixir of Life and Cure for Lung Disease" is only pure water, and is directed to be given in small doses.

A "Soothing Powder" is pure rice starch.

Another "Salt of Life" is only common saltpetre.

"Radway's Ready Resolvent" is sugar, ginger, and cardamom.

A "Nerve Balsam" is oil of lemon, oil of bergamot, and cardamom.

"Nerve Spirit" is oil of lavender, oil of rosemary, and alcohol.

"Golden Medical Discovery" is laudanum, lettuce extract, honey, and bad whisky. It contains no discovery, and is very far from being "golden."

Cosmetics are sometimes harmless, but sometimes contain corrosive sublimate or chloride of mercury, which is rapidly absorbed through the skin, and is a deadly poison. Of twenty-one hair dyes, analyzed by Benjamin, a New York chemist, fifteen were poisonous.

Of advertised remedies for rheumatism, some contain salicine, one contains red pepper, liquorice, and sugar; and one is nothing but alum and common salt.

Remedies for epilepsy generally contain bromide of potassium. Of nineteen such remedies, analyzed in Germany, only four contained bromide of potassium; fifteen were valueless. One of these was spirits of camphor; another was only roasted acorn. Not one of them would have been bought by anybody who knew what it was made of.

Of six ague cures, analyzed at Ann Arbor, five contained the cheaper alkaloïds of Peruvian bark, that is, substances similar to quinine, but cheaper and poorer. Two had red pepper, two had sulphuric acid, five had molasses, and one had wintergreen oil. One was only tincture of chloride of iron, molasses, and powdered charcoal. These were all advertised as new discoveries.

A few years ago an immense business was done in a certain line of patent medicines which were sold under the general name of "Bitters." Their character may be inferred from the following analyses made by Prof. Wm. R. Nichols for the Board of Health of the city of Boston. The first column contains the percentage of alcohol by volume, and the second the number of grains of solid matter to the fluid ounce:—

No. 1. Richardson's Bitters.....	59.	4.5
" 2. Boker's Stomach Bitters.....	46.	22.
" 3. Atwood's Quinine Tonic Bitters.....	42.	25.
" 4. Hostetter's Stomach Bitters.....	41.	21.
" 5. Rush's Bitters.....	35.	16.
" 6. Dr. Job Sweet's Strengthening Bitters.....	31.	18.
" 7. Dr. Fisch's Bitters.....	29.	28.5
" 8. Colton's Nervine Strengthening Bitters.....	27.5	27.
" 9. Dr. Hartshorne's Jaundice Bitters (Key to Health).....	25.	13.
" 10. Dr. J. O. Langley's Root and Herb Bitters.....	25.	4.5
" 11. Atwood's Vegetable Bitters.....	23.	62.
" 12. Dr. Flint's Quaker Bitters.....	21.5	28.
" 13. Dr. Warner's Bilious Bitters.....	18.5	116.
" 14. Speer's Standard Wine Bitters.....	18.5	18.
" 15. Clarke's Sherry Wine Bitters.....	18.	19.
" 16. Dr. Wheeler's Tonic Bitters.....	18.	21.
" 17. Dr. Hoofland's German Bitters.....	14.	23.
" 18. Dr. J. Walker's California Vinegar Bitters.....	6.	36.5
" 19. Dr. Pierce's Bitters.....	4.	87.
" 20. Oxygenated Bitters.....	0.	Undetermined.

To this list may be added, according to the analysis of Dr. Kedzie, No. 21, Drake's Plantation Bitters, which has 35.25 per cent of Alcohol.

It will be observed that the only article in the above list which contains no alcohol is Oxygenated Bitters, the most prominent ingredient of which, according to Professor Nichols, is sulphuric acid.

A glance at the list shows, moreover, that only two of these bitters contain less alcohol than Champagne or Burgundy; a majority of them are as strong as, or stronger than the fortified wines of commerce; several are about equal to ordinary poor brandy or whisky, and one even excels proof spirit in amount of absolute alcohol. As for the solid matter contained in these bitters, imagination fails in any attempt to conceive what it may be.

The following lively extract, from Dr. Gibbons, of California, may assist the imagination of those who are slow to believe anything of the resources of human ingenuity in the invention of bitters :—

"In the concoction of the various kinds of bitters, there is but little else than fraud, \* \* \* The veriest fool can manufacture medicinal bitters—an experiment which has been successfully tried over and over again. The process is admirable. Some child of toil, who has grown weary of wiping the sweat from his brow, buys a lot of the cheapest whisky which the market affords, and steeps in it one or more bitter herbs which he finds at hand. He gives the decoction a distinctive name and calls himself 'Doctor,' though he has never so much as held a doctor's stirrup or blacked a doctor's boots. The formula for medicinal bitters in general runs thus: Take of cheapest whisky, an indefinite quantity; of any bitter vegetable, herb, flower, root, or bark, *quantum suff.* Mix and flavor with anything or nothing. Put in bottles, and employ an expert liar to write labels and certificates. Present a few bottles to editors and clergymen of taste. Advertise largely, and sell for 500 per cent above cost of material."

The cost of material of all patent medicines is out of all decent proportion to the selling price. A druggist tells me that many patent liniments, for instance, which sell for 50 cents per bottle, are made of mustard and alcohol, at an original cost of about three cents.

But I have certainly given facts enough to prove my assertion that patent medicines are not what they pretend to be. The claim that they are new dis-

coveries is in every instance absolutely false ; nor is any one of them in any sense "scientific;" nor are they in the least degree the result of study or experiment.

Moreover, some of the best known patent medicines have had their ingredients changed, without any notice of the change made public. For instance, a German powder, which for 70 years has been advertised to cure epilepsy, has been changed at least three times. At one time it contained magnesia; at another, muriate of ammonia; at another, valerian root. Its only constant ingredient was the oil by which it was scented. The active principle of Mrs. Winslow's Soothing Syrup was originally morphine; it is now oil of fennel.

I think it will be admitted by this time that not only are patent medicine makers for the most part incompetent and irresponsible persons, not only are the medicines themselves something else than what they pretend to be, but that there is involved in the making and selling of many of them that which can be characterized only as outrageous humbug and fraud. Think of the almost hopeless epileptic patient, who yet reaches out a hand for one more remedy which may perchance save where so many have failed, and then find if you can a fitting epithet for the character of the man who cruelly deceives him with powdered acorns! What a heartless practical joke is perpetrated upon the neuralgic sufferer to whom is sold a bottle of water as a newly discovered remedy! or upon the tortured victim of rheumatism who is fooled by printed lies into a test of the mixture of alum and salt! How many thousands of persons have paid a dollar a bottle for a little red pepper, ammonia, and alcohol? And how many were swindled by the flaming advertisements of "Ozone," a worthless compound of sulphur and charcoal, with a little ground cinnamon.

Carlyle has been roundly criticized for his rude statement that Great Britain contained "forty millions of people—mostly fools;" but in view of the gullibility of the vast army of buyers of patent medicines, who dare say that he was wholly wrong in his blunt characterization?

It is not a sufficient answer to the above presentation of facts to say that patent medicines are known to have done some good. It is certain that they have never done a tenth part of the good popularly ascribed to them. In the vast majority of instances in which they are supposed to be used successfully, the sick person would recover just the same if the medicine were not used at all. Nature does the real work of restoration, and the medicine receives the credit and its maker the profit. In fact every reputable physician occasionally prescribes bread pills, or something equivalent thereto, well assured that any drug which he might prescribe would do no good and might do a great deal of mischief.

In another large number of instances the influence of imagination is the real factor in the work of recovery, although here again the patent medicine erroneously receives the credit. Dr. Hammond states that the influence of imagination is much relied upon by the best physicians in hospital practice, especially when dealing with ignorant and superstitious patients. He gives an account of a patient who believed that he would be cured if he could drink of the "Water of Lourdes," and he was effectually cured, although the remedy employed was nothing but Croton water with a false label. Another patient believed that his disease would leave him if he could be rubbed with a bone from a dead saint. His fancy was gratified and he recovered, although the dead saint's bone was in reality a piece of the broken handle of an old tooth-brush.

As matter of fact, patent medicines are not made for the purpose of curing

disease. If any one in surprise chooses to inquire, what then are they made for? the answer is simple. Like the peddler's blunt razors which would not cut, they are made to sell. This result is the only one really aimed at by their maker and proprietor, and this result he secures by ingenious advertising and its effect on popular ignorance. The exceptions to this statement may be counted upon the fingers.

It may be admitted that patent medicines serve to illustrate one good thing, namely, that people with headache and gout, dyspepsia and neuralgia, really wish to get well. Their purpose is good, even when they mistake the method and waste their money. They seem too often to obey the children's rhyme:

"Open your mouth and shut your eyes,  
I'll give you something to make you wise."

But neither true wisdom nor good health come in any such way. The one, as the other, is a result of careful discrimination and constant self-control. In the hurry and battle of modern life, no one, however wise and careful, can always keep well; but every one can learn that health is to be restored, when lost, not by any magic potion, but by a careful following of those laws of health which are founded upon a real knowledge of bodily functions. Even this knowledge very few have either time or inclination to obtain, and, therefore, the sole resource for most of us, in case of serious illness, is the advice of a physician.

But doctors, it may be maintained, are not infallible, and are sometimes grossly ignorant. This is undoubtedly true; nevertheless, in every community there are intelligent and honest physicians, men who may not be infallible, but who at least know all that is known with regard to the body and its functions; men who are on the alert for every new revelation of science in medical treatment, and with the ability necessary to discriminate between the true and the false; men who are patient, industrious, and self-sacrificing; men who have won reputation by persistent study and work; men in every sense worthy of your confidence; men who know something of the danger of tampering with the body, and who will carefully discriminate with regard to personal condition and special requirement before prescribing any medicine or giving even a word of positive advice; and it is not to the credit of the intelligence of the American people that these men are often passed by, and money is expended upon the harlequin advertiser of patent nostrums, who is without honor, without conscience, without knowledge; and who, intent only upon money-grabbing, is careless of the mischief which his recklessness inflicts.

The evil wrought by patent medicine vending, in my opinion, is beyond the reach of law. But law can and should establish one great safeguard. It should be made the duty of every medicine compounder to attach to the bottle or package which contains his nostrum a printed label containing the names and exact proportions of all the ingredients employed. All persons have a right to know just what they are buying; and a law of this kind could be easily enforced. Whoever then chooses to buy and use must be permitted to suffer the consequences of his own mistaken judgment.

Great good may be done, in time, by a better teaching of physiology in our public schools, and other good methods of abating the patent medicine nuisance might be advocated. But my purpose has been to call attention to the utter irresponsibility of the makers of these widely-used compounds, to the fact that they are seldom or never what they pretend to be, to the gross frauds connected with their manufacture and sale, and to their deleterious effects not only on people's pockets but upon the public health.

Dr. Henry B. Baker, of Lansing, Secretary of the State Board of Health, then read the following paper:—

## TYPHOID FEVER AND LOW WATER IN WELLS.

BY HENRY B. BAKER, M. D.

(Another paper on this subject was read by the author at the meeting of the American Public Health Association, at St. Louis, Mo., in Oct., 1884.)

In March, 1856—nearly thirty years ago—Prof. Max von Pettenkofer, of Munich, Bavaria, commenced making systematic observations and records of the depth and oscillations in the depth of the ground-water. In 1863, Dr. Buhl compiled the deaths from typhoid fever in the public hospitals, and compared them by months with the records of the oscillations of the ground-water. "This resulted for the first time in proving a regular coincidence, plain for everybody, ground-water falling typhoid rising, ground-water rising typhoid falling." That is what Prof. Pettenkofer said in his work on this subject published at Munich in 1869.\* Buhl's results were not generally accepted as conclusive, even though mathematical computations by Bernoulli and Seidel showed that the probabilities were as 36,000 to 1 that the relation was not an accidental one. It was objected that the number of deaths were too few, and the period of time (eight years) was too short. This work was followed by Wagus who charted the deaths from typhoid in the whole city of Munich from 1850 to Dec., 1867. The comparison with the ground-water was then possible for nearly 12 years. The result was wonderfully striking: The greatest typhoid epidemic coincided with the lowest ground-water, the second greatest with the second lowest, and the third greatest with the third lowest; the least prevalence of typhoid coincided with the highest ground-water, and the second least prevalence with the second highest ground-water. It was found that the data prepared by Buhl, on which Seidel based his calculations of probabilities, were entirely satisfactory.† Two years later, Prof. Pettenkofer published his "*Boden und Grundwasser in Ihren Beziehungen zu Cholera und Typhus*." Pettenkofer's work is known throughout the world; and yet little or nothing practical has been done; and recent writers on typhoid in most countries, excepting Germany, have almost entirely ignored the relation of oscillations of the ground-water to typhoid fever. Probably this is because Prof. Pettenkofer's interpretation of the facts that he presented, and his view of the mode of causation of typhoid fever has not accorded with the great masses of facts recently collected bearing upon the causation of that disease. He did not believe that typhoid fever was generally caused by bad drinking-water. If I understand Pettenkofer's view, it was in 1869, that with the recession of the ground-water the air enters deeper into the soil, and stimulates into activity and multiplication disease germs which lie dormant when under water. These germs permeate this ground-air, and whenever the barometric pressure is low, or other conditions favor its upward movement, the germ-laden air rises from the soil and enters houses and causes typhoid fever.

I believe we have now collected sufficient facts relative to the way in which typhoid fever is most frequently spread, namely, by infected drinking-water, to enable us to make that grand use of the labors of Pettenkofer, Buhl, Seidel,

\* *Boden und Grundwasser*, etc., page 15.

† "*Boden und Grundwasser*, etc.," Pettenkofer, page 16.

and others, which could not be made so long as their interpretation of their facts was adhered to.

At the time Pettenkofer wrote there were many theories as to the causes of typhoid fever; I say causes, using the plural form, for the reason that the idea was not then so prevalent as it now is that there is but one cause of that fever, and that cause a specific organism. The accumulation of evidence has now made it apparent that the disease is more frequently traced to bad water than to any other condition whatever. The disease does not usually, if ever, spread by contagion. It is not therefore communicated through the air from person to person. Its communicability through the air from foul places is not often, if ever, definitely proved. It does not increase as cities are sewered; on the contrary it generally diminishes. In this connection an account of the enormous reduction of typhoid fever in Munich, coincident with the construction of sewers, is interesting and suggestive. "At Munich the enteric [typhoid] fever mortality per 1,000,000 of inhabitants for quinquennial periods was as under:

"1854 to 1859, when there were absolutely no regulations for keeping the soil clean, 24.2.

"1860 to 1865, when reforms were begun by cementing the sides and bottoms of porous cess-pits, 16.8.

"1866 to 1873, when there was partial sewerage, 13.3.

"1876 to 1880, when the sewerage was complete, 8.7."\*

There was thus in Munich a reduction, coincident with sanitary work, of two-thirds of the mortality from one of the most deadly diseases.

The sewerage of a city generally lowers the level of the ground-water wherever that level is near the surface of the ground; and yet sewerage of cities usually lessens typhoid fever. This indicates that the cause of typhoid fever is not porous earth filled with air, but that it is some other condition which is improved by sewerage.

As an illustration of the influence of sewerage in draining and lowering the ground-water near the surface, I may mention that along a certain street in Lansing, Mich., wells which had supplied water to the inhabitants for many years were drained dry immediately after the sewer was completed on that street. That is one way in which the use of impure surface water is stopped by the construction of sewers.

Coincident with the sewerage of a city is usually the supplying it with water from a general source; and this puts an end to, or greatly reduces, the use of water from wells. All this means much, very much, to the life and health of the people; and *typhoid fever* is the disease which good sewerage and a pure water-supply will do so much to protect us from. Two-thirds of the deaths from this disease were in this way stopped in Munich, according to the statistics which I have already quoted. How much does this mean to the people of Michigan? Probably about two-thirds of one thousand a year, or 666 lives which may be thus saved in every year, in this State. Typhoid fever is not more prevalent in Michigan than in other States.

Turning now to the evidence of the relation of low water to typhoid fever in Michigan; during the last six months of the year 1881, and the first three months of 1882, sickness from typhoid fever was, I believe, much more than usually prevalent in the State of Michigan. The evidences of the truth of this

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\* Extract from an address by Captain Douglas Galton, quoted from "Proposed Plan for a Sewerage System, etc.," by Samuel M. Gray, C. E. Providence, R. I., 1884. Pages 7-8.

statement are found in the Annual Reports of the Michigan State Board of Health; and they consist of replies by regular correspondents to questions asked by the Board,\* and of tables, compiled from weekly reports of sickness, made by health officers and other prominent physicians in different parts of the State.†

TABLE 1.—*By year and months for each of the six years 1878-83, and on an Average for the Five Years, 1878-82, stating on what Per Cent of the Weekly Reports of Diseases received Typhoid Fever was reported present.*

YEARS.	Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Av. 5 yr. 1878-82	13	12	11	8	6	6	6	8	15	22	25	23	17
1878-----	10	12	9	7	4	7	6	6	10	13	18	11	12
1879-----	12	6	5	6	8	3	4	5	14	20	24	25	17
1880-----	14	8	13	7	5	6	5	10	19	26	23	22	17
1881-----	18	13	10	7	5	6	6	12	23	35	37	32	25
1882-----	14	21	16	12	8	7	9	8	11	17	23	23	16
1883-----	11	11	7	7	7	6	7	6	11	19	21	17	14

By the table (No. 1), which is here submitted, it may be seen that, beginning with July, 1881, the sickness reported from typhoid fever was about fifty per cent greater than the average for corresponding months in the five years, 1878-1882; and it continued at this high rate until April, 1882.

By a careful study of the reports by meteorological observers for the Michigan State Board of Health, and of other evidence relative to the condition of the soil and of the ground-water, immediately preceding and during the prevalence of this unusual sickness from typhoid fever, it is found that it was a time of unusual drouth and low water in wells, beginning with July, 1881, and that, although the rainfall later in the year was sufficient to make the surface-soil moist, the water in wells continued unusually low. It was especially low in July, August, and September, 1881.

I submit herewith a diagramatic table (No. 2) in which is summarized the evidence which seems pertinent, that was contained in replies by regular correspondents of the Michigan Board of Health, relative to the months in the year 1881, in which the ground-water, as observed in wells, was unusually low, and the months in that year in which typhoid fever occurred under their observation. It may be seen that in quite a number of localities observers have made records which show either a coincidence between the low water and sickness from typhoid fever, or that the fever occurred in months succeeding the low water.

I have shown that the *sickness* from typhoid fever in Michigan was unusually great in the last part of the year 1881 and first part of 1882 compared with other years, according to reports extending back to 1876. The *deaths* from typhoid fever were also unusually numerous in the year 1881, compared with other years. The mortality statistics extend back to the year 1866.

I have compared reports of the meteorological and other conditions in the years 1881-82 with those for other years; and I find no condition, concerning which we have records, that varied in such manner as to explain the unusual

\* pp. 285-9, Report 1882.

† p. 568, Report for 1882, and p. 241, Report for 1883.

prevalence of typhoid fever in those months, except the condition of the ground-water, as indicated by the lowness of water in wells.

From the foregoing it appears that in Michigan there is a relation between low water in wells and the prevalence of typhoid fever; that this relation is found to hold by seasons of the year,—those months in which the water is lowest (or the months immediately following) being the months in which typhoid fever is most prevalent; and the unusual year 1881–2 when typhoid fever was more prevalent than ever known before, was also unusual because of the exceeding low water in wells.

A relation of low water in wells to the prevalence of typhoid fever being considered established, several questions arise:—

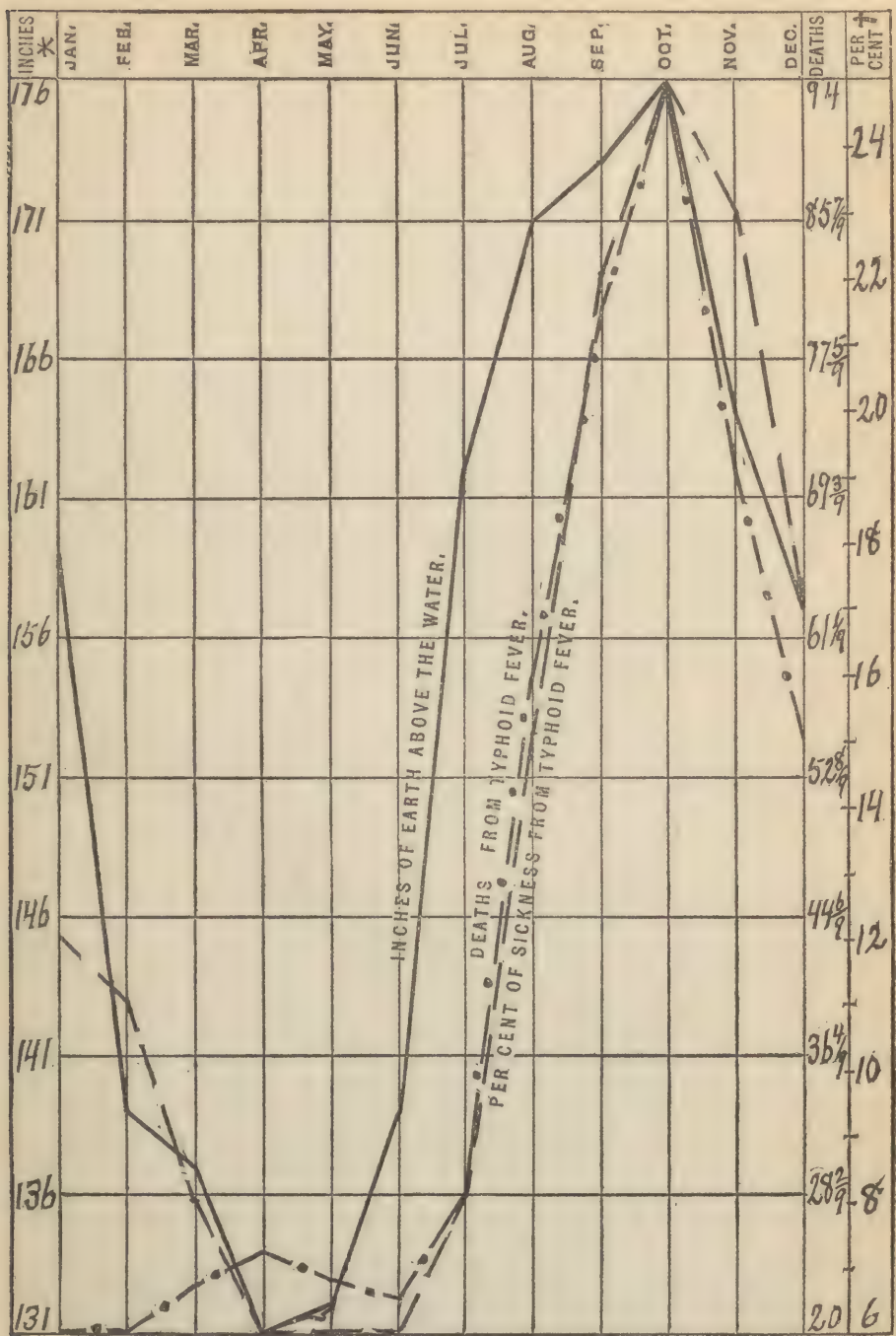
1. Is there a quantitative relation? That is to say: Is the amount of sickness from typhoid fever proportional to the amount of water in wells?

IS SICKNESS FROM TYPHOID FEVER INVERSELY PROPORTIONAL TO QUANTITY OF WATER IN WELLS?

At first glance it may seem to be impracticable to measure and compare quantitatively such dissimilar things as water in wells and sickness from typhoid fever. Yet whenever we can get the statements of the facts such comparisons are now not difficult. We have only to construct diagrams on the proper principle, and accurately drawn according to definite scales. It may be well to say here, that the way to do this is to so plan the diagrams and the scales by which the two or more things to be compared are to be shown that the *extremes* of the two or more things to be compared (the highest and lowest statements in the diagram) shall be the same distance apart,—in which case the greatest *range* of the statements for each will appear to be the same. In a diagram prepared in accordance with this principle, if there is a fixed and definite quantitative relation between the things compared, it will be apparent; because the greatest ranges of the several things compared being *made* to coincide, the minor fluctuations will also coincide in the amount of space they occupy on the diagram.

This principle, just stated, has been held in mind in the preparation of the diagrams which I present to you, and which show the relation of the depth of the earth above the ground-water in wells in Michigan, and the prevalence of sickness from typhoid fever in Michigan by months in each of the years 1878, 1879, 1880, 1881, 1882, and 1883, also an average for five years,—1878–1882, this diagram also including statements of the deaths in Michigan from this cause during the same five years. In these diagrams, statements of the “depth of earth” above the water in wells, have been employed; because if statements of the “depth of water” in wells were used the scale would, if upright, have to be the reverse of that used for the statements relative to the sickness, and therefore would not be as easy of comparison. In studying these diagrams, one will need to bear in mind that whenever the “depth of earth” over the water is great, the depth of the water in wells is low, and *vice versa*.

DIAGRAM A.—Exhibiting, for a period of Five Years (1878-82) the Average Monthly Oscillations of Ground-water in Michigan, the Deaths from Typhoid Fever, and what Per Cent of the Weekly Reports of Sickness Received Stated the Presence of Typhoid Fever.



\*Inches of earth above water in wells.  
 †Of all weekly reports received, per cent stating presence of typhoid fever.  
 NOTE.—The sickness-curve should rise and fall later than the curve for its cause by about the

## WHAT THE DIAGRAMS SHOW.

In the several diagrams which I present, the statements of the sickness from typhoid fever relate to the State of Michigan as a whole,—being summarized from weekly reports of physicians in many parts of the State. The wells measured for these diagrams are not the same in number in both years; and they are not the same wells in both years; so that from the diagrams alone no comparison can be made of one year with the other as to the exact height of the water during the year as a whole, or of one month with the corresponding month in another year. The comparisons intended to be shown are of one month with the others in the *same* year. The number of wells was very few; but an examination of the subject seems to show that it is sufficient to fairly indicate for each year the rise and fall of the ground-water throughout the State,—the curves are as nearly alike as one would expect them to be in different years.

From the diagrams it may be seen that, beginning with June in each year, the sickness from typhoid fever follows more or less closely the curve representing the average depth of earth above the ground-water. If the sickness is caused by the low water there is good reason why the curve of the sickness should *follow* the curve representing the lowering of the water; because the statement of the sickness is: What per cent of weekly reports received stated that typhoid fever was under observation during the week for which the report was made; and as the disease lasts for about three weeks, and as cases taken sick in preceding weeks will remain under observation until death or convalescence and be reported together with those just taken sick, the curve for sickness would, when rising or falling, necessarily lag behind the curve representing the cause of the disease, by about the average duration of the disease. As there is in this disease an incubation period of varying length, but which may be ten days, two weeks, or even more, this would still further postpone the sickness, compared with a curve representing its cause. Usually a few days of sickness pass before the doctor is called and the disease recognized and reported as typhoid fever. So that if low water causes the sickness, we would expect as a rule to find the changes in the amount of sickness to appear to lag behind the changes in the level of the water by about one month. This is very nearly what we do find shown by the diagram relative to the average for the five years, and with respect to each of the years 1878, 1880, 1881, and 1883,\* namely, that the rise or fall of the disease appears to be greatly influenced in any month, after May or June, by the level of the water in that same month, but that the influence extends over into the succeeding month.

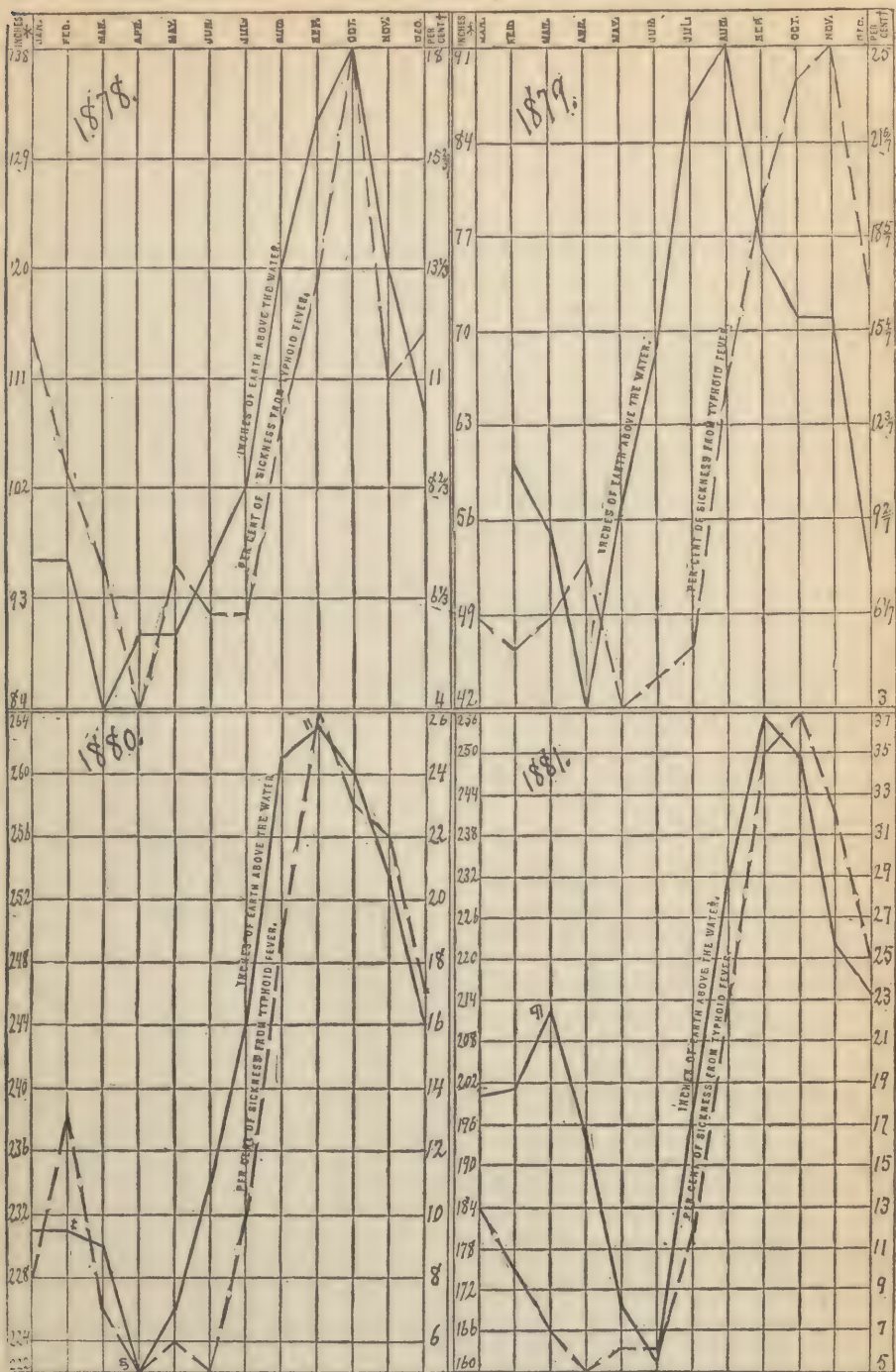
The comparison between the depth of water in wells and the sickness from typhoid fever being so close for every month after June, what is the reason for the want of correspondence in several years from January to June? By the diagram for the year 1881 it may be seen that the earth above the water increased from January to March and decreased from March until June, while the sickness seemed to decrease because of the low water in wells in March, and to increase in consequence of the rise of water in April. In considering this subject, it seemed to me that the cause of the low water in March, 1881,

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length of the period of incubation plus about the av. duration of the disease; because the reports of sickness include all cases under observation, old cases and new cases. The time-unit of the diagram is so great (one month) that the interval between the two curves is sometimes greater and sometimes less than the interval between the supposed cause and its consequent sickness.

\* If the diagrams were made by weeks instead of months it might be found that the relation is more definite and constant than appears by these diagrams; but this remains to be ascertained.

DIAGRAM B.—Exhibiting the Rise and Fall of Water in Wells, and of Sickness from Typhoid Fever, in Michigan, in each of the Four Years 1878-81.



\*Inches of earth above the water.

†Of all reports received for the given month, the per cent stating the presence of typhoid fever.

‡Well-water high, but not protected by frozen ground; organic matter decomposing.

§Depth of earth above the water least,—water highest; least sickness from typhoid fever.

|| Depth of earth above the water greatest,—water lowest; most sickness from typhoid fever.

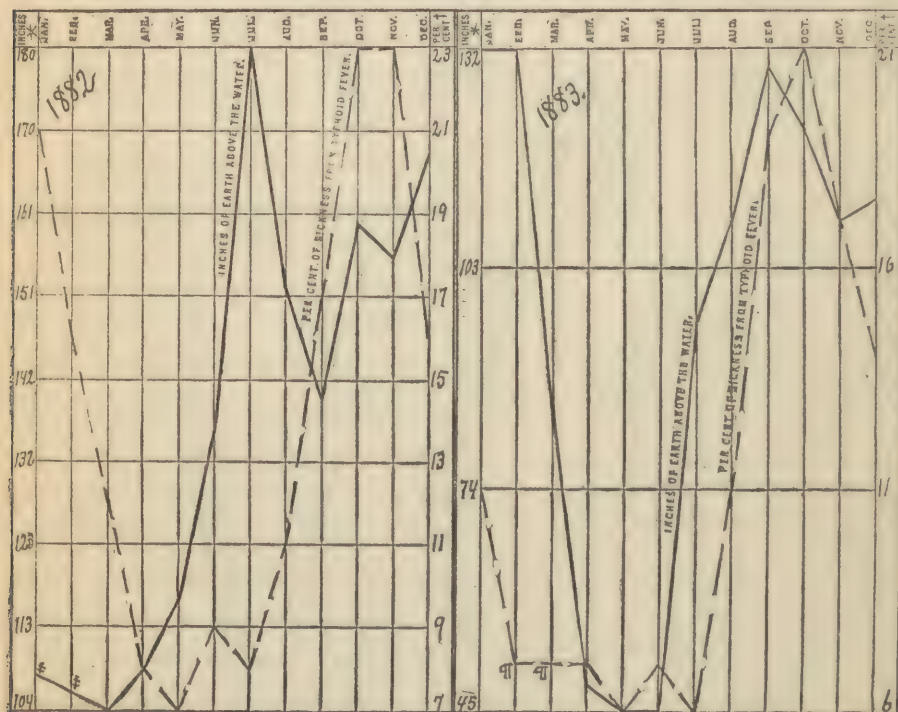
¶ Well-water low, but protected by frozen ground.

might be the great depth to which the ground was frozen; and that the reason why the sickness was decreased might be that the privies and other sources of typhoid contamination were also frozen, and the liquid therefrom prevented from descending to the water in the wells. The water in the wells would then be derived in greater proportion by percolation from a distance, in some cases from streams not frozen. In either case, whether the water in wells came from a distant stream above ground, or from the general level of the ground-water, the ground above being frozen deeply, the water which enters the wells would be filtered much more slowly through the deep strata of the earth than is the case when rain passes freely down to wells through foul surface-soil. To learn whether this supposed explanation accorded with the facts, I have turned to the reports by the meteorological observers for the State Board of Health, and I find they reported relative to the weather in the first part of the year 1881, as follows:—

*January.*—One says—"Ice about 25 inches thick; ground deeply frozen." Another says—"January, 1881, was the coldest, judging from its mean temperature, of any January since 1875."

*February.*—"Ground frozen four feet deep." "Frost four feet deep in the cemetery; soil, sand and gravel." "Average depth of frozen earth in cemetery, 3 feet."

DIAGRAM C.—*Exhibiting the Rise and Fall of Water in Wells, and of Sickness from Typhoid Fever, in Michigan, by Months, during each of the Years 1882, 1883.*



\* Inches of earth above the water in wells.

† Per cent of reports of sickness from typhoid fever.

‡ Well-water high, but not protected by frozen ground; organic matter decomposing.

§ Well-water low, but protected by frozen ground.

*March.*—"Ground frozen to the depth of 18 inches."—*Sergt. Jas. J. Fitzgerald, Alpena.* "The lakes and ponds are still frozen." "Ice began to move in Grand River, Lansing, March 28."

The great depth to which the ground was frozen in February and March will, I think, explain the great freedom from typhoid fever in Michigan in March, 1881. If this is the true explanation, it indicates that the condition of the low water in wells is generally not productive of typhoid fever when the comparatively low water is protected by a deep freezing of the privies, cess-pools, and the general surface of the earth. We have previously seen, and it is apparent from several of the diagrams, that from June to December *low* water in wells is *not* favorable to freedom from typhoid fever.

Turning now to the diagram representing the relation of water in wells to typhoid fever in Michigan in the year 1880, it is noticeable that in the early months of that year the water was *high* (the depth of earth above it was not great), and that the typhoid fever was also high. The reasoning adopted relative to the early months in 1881, where the deeply-frozen ground was believed to have prevented typhoid fever, would lead us to suppose that the well-water was *not* protected by frozen ground in 1880. Inspection of the records shows that this is true, that in Michigan the earth was *not* as deeply frozen as usual during the months of January and February, 1880.

The unusual prevalence of typhoid fever in Michigan in February, 1880, is probably fairly attributable to the unusually mild weather in January and February, and to the lack of protection usually afforded by the frozen ground at that season of the year to the water in wells, which water, by reason of the injury to vegetation by alternate freezing and thawing, was probably unusually contaminated by decomposing organic matter, in addition to the leaching from privy-vaults.

From the evidence in the tables, diagrams, and comments in this paper, it may be seen that not only in the spring of 1880, but in the early part of other years, typhoid fever was prevalent coincidently with an unfrozen surface of the ground. The year 1882 is another example of high ground-water and high rate of *sickness*, during the first few months of the year. By reference to the reports of meteorological observers it is found that February and March, 1882 were unusually mild months.

We thus reach the conclusion that, in Michigan at least, the relation of the depth of water in wells to typhoid fever is not the same in summer as in winter; that in summer when vegetation is active and not decaying, a lowering of the water is uniformly followed by increased prevalence of typhoid fever; with the advent of colder weather there is a rise in the water-level which is uniformly followed by a decreased prevalence of the fever; that this decrease continues through the winter and spring, even though the level of the well-water is lowered, *provided* the surface of the earth is deeply frozen; that on the contrary, *high* water-level in wells in winter and spring, coincident with ground *not* thoroughly frozen, is followed by *increased* prevalence of the fever. Briefly stated, the typhoid fever follows *low* water in summer, and *high* water at that season of the year when the ground is usually thoroughly frozen.

#### WHAT CONSTITUENT OF THE DRINKING-WATER CAUSES THE TYPHOID FEVER?

Typhoid has been known to occur after the drinking of water contaminated by decomposing vegetable matter (turnips in one instance); by decomposing

*animal* matter (a turtle in one instance); also in the autumn succeeding a hot summer in which diarrhea had been unusually prevalent; and the unusual fouling of the water-supply by the extra quantity of fecal discharges under these circumstances has been supposed to have causative relation to the typhoid fever which succeeded it. All this receives explanation if we accept the doctrine that typhoid fever is caused by bacteria; because bacteria require for their growth and multiplication a nutritive solution,—either mineral (such as Pasteur's), or vegetable, or animal, very few, if any, of the many species of bacteria being able to reproduce themselves in great numbers in *pure* water.

Bearing upon the question of a specific cause for typhoid fever, are many well-known outbreaks, especially those at Caterham and Red Hill, England; at Lausanne, Switzerland; and Dr. Austin Flint's cases at New Boston, N. Y. The cases at Lausanne strongly indicate that the cause of typhoid fever is specific; and the cases recorded by Dr. Austin Flint can hardly be explained on any other hypothesis; nor can the cases reported by Dr. Gaffky. The Adrian (Mich.), outbreak, in the fall and winter of 1883-4, also supplies strong evidence that the disease was spread by the discharges from a first case, infecting the drinking water.

Klein, (\*) Klebs, (+) and many other eminent histologists have thought that typhoid fever is caused by a specific bacterium, although they have not agreed as to which of several described forms should be considered the *true typhoid bacterium*. A recent view is that the forms seen by Klein and Klebs in the diseased Peyer's glands are secondary invasions, and that the real cause of the disease is a peculiar short, thick bacillus with rounded ends, found during the fever not only in the diseased Peyer's patches in the intestines but also in various other organs of the body, as the liver, spleen, and kidneys. This bacillus has been described by Eberth, Meyer, and Friedländer, and is believed by them to be specific. Koch has confirmed the statements made by these observers, and Ziegler says this bacillus is "probably the exciting cause of the disease."† The statements of Eberth, Meyer, and Friedländer have been again confirmed quite recently‡ by a series of very exhaustive and carefully conducted microscopic examinations by Dr. Gaffky, of the Imperial German Board of Health. These bacilli have been found by him in 27 out of 28 cadavers examined, and have never been found, either by himself or by the other investigators named, except in typhoid cases. Dr. Gaffky cultivated this typhoid bacillus outside of the body on various nutritive substances, as gelatin, meat-broth, fluid blood-serum, boiled potatoes, and also in *vegetable solutions*, although in the latter they grew less vigorously.

#### HOW IS TYPHOID FEVER INDUCED BY LOW WATER IN WELLS?

The evidence of the causation of typhoid fever by low water in wells will not be accepted by most persons, unless they understand how the disease can be thus caused. Several persons to whom I have presented some of this evidence have replied that they could understand how dilution of a *poison* would lessen its effects; but that if typhoid fever is caused by a specific organism, they failed to see how the low water in wells could cause the disease. A study of the relations of privies to wells, and the statement of certain facts may aid

\* Intimate Anatomical Change in Typhoid Fever: Reports of the Medical Officer of the Privy Council and Local Gov't. Board. London, 1875. Also, *Public Health*, June 16, 1876, pg. 463.

† Archiv. fur exper. Pathologie, 1881.

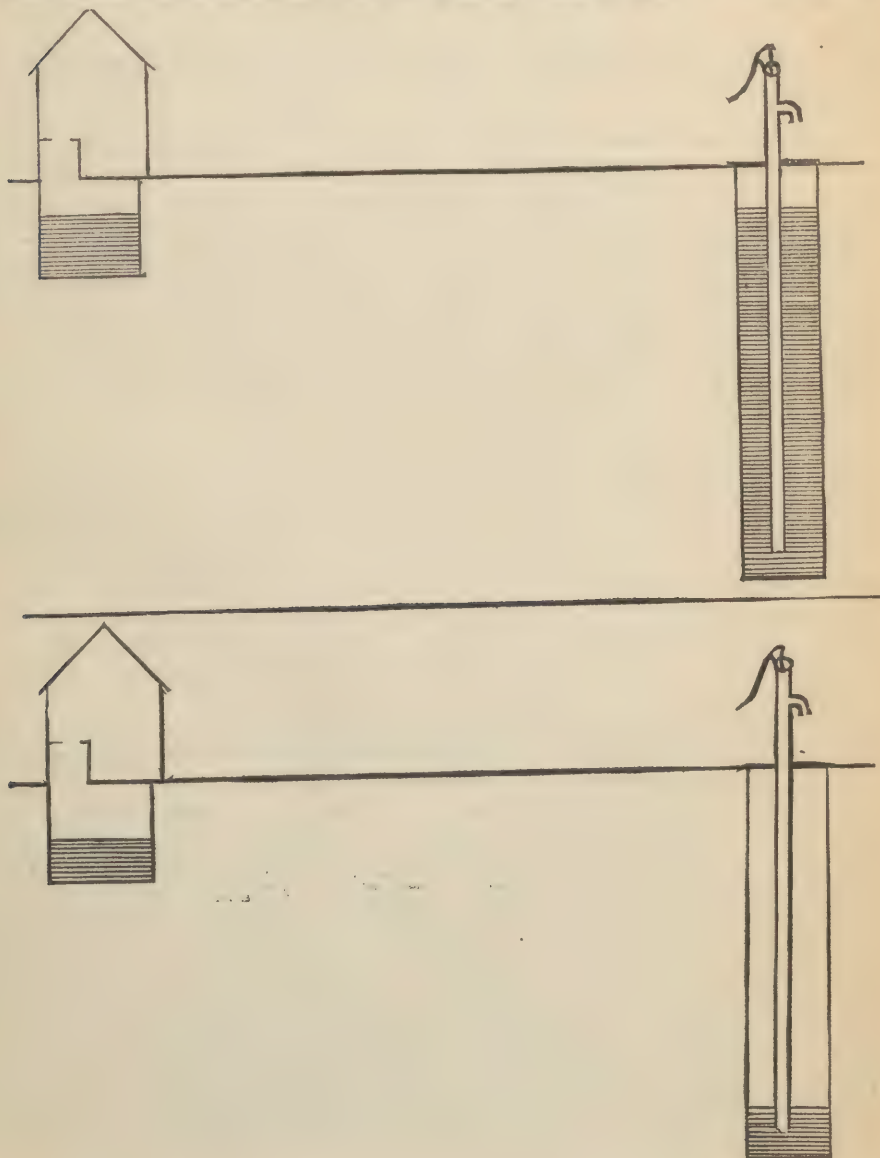
‡ Pathological Anatomy. London, 1883, Part I, page 300.

|| Zur Ätiologie des Abdominal typhus; Mittheilungen aus dem Kaiserlichen Gesundheitsamte. Band II., 1884, pages 372-403.

such persons to an understanding of how it is possible to explain such mode of causation.

Herewith I submit a diagram, page 27, showing a privy and a well under two circumstances; in one case the water in the well is low, and in the other case it is high. It would seem that when the level of the water is the same in the well as in the privy, there would not be likely to be a mingling of the water

DIAGRAM D.—*Illustrating the Proposition that the Fluids Cast into a Privy bear a Relation to the Water in a Well Not Far Distant, which Relation is Different When the Water in the Well is High from What it is When the Water is Low.*



from the privy with that in the well, unless the distance between them was small. But whenever and wherever the water in the well is below the bottom of the privy not far distant, there will be a strong tendency of the fluids cast into the privy to pass downward toward the water in the well; or, if not directly to the well, to the ground-water not far distant, which will pass into the well to replace that which is drawn. That is only one way of rendering the water foul, or, as we might say, nutritive to bacteria; and it is quite in keeping with other evidence as to outbreaks of typhoid fever after the use of water contaminated by decomposing animal and vegetable matter. The explanation of all these lines of evidence would seem to be that either the ordinary bacteria of decomposition cause typhoid fever, or that there is a specific cause of the disease quite generally distributed, *and that it is capable of self-multiplication*, whenever it falls into fluids sufficiently nutritive, and under the other favoring conditions.

I think we may now safely assume that there is a greater dilution of the dejections from typhoid-fever patients, and of human excreta generally, when the water in wells is high than when it is low, except when the low water is caused by a frozen ground which locks up the excreta on the surface of the earth. It cannot yet be positively asserted that the specific cause of typhoid fever is reproduced outside of the body in nutritive solutions at the temperature of water in wells; yet this may be found to be possible, or, if not in wells, in the higher temperature of privy-pits, from which it may pass into the well, either at once in the form of mature bacilli, or after a time in the less perishable form of spores; and if typhoid fever is caused by the ordinary bacteria of decomposition, as many seem to believe, then we must consider that lessening the quantity of water in wells would probably (except as just mentioned) lessen the dilution of the fluid derived from privies, and consequently increase the proportion of bacteria thus introduced into a given quantity of well-water; and not only this, but the proportion of albuminoid matter suitable for the rapid reproduction of bacteria would then be increased; and, bearing in mind how rapidly the reproduction of bacteria occurs under such circumstances, we can well understand how in such a "culture fluid" there would soon be something of very much greater import than simply what would result from a lack of dilution of fluid containing some organism or poison not capable of self-multiplication.

Many years since Chauveau\* performed a series of careful experiments with vaccine virus diluted with constantly increasing quantities of water, when he found that the proportion of successful vaccinations was correspondingly decreased. Under these circumstances it appeared that whenever there was a lodgement of the virus the development of the case proceeded regularly to the close; but with large quantities of water the proportion of such cases of successful vaccination was very small. I suppose that no one now doubts that vaccinia is caused by specific particles which are reproduced within the body (it is now many years since vaccinia was shown to be due to a "particulate" cause, and those same experiments by Chauveau had much to do with establishing that fact; however, Dr. Burdon-Sanderson's experiments verified those made by Chauveau, and have been considered sufficient to establish this point). The two points just alluded to (the lessened chance of vaccination with diluted virus, and the fact that vaccinia is a specific disease) may serve to remind those who have not held these facts in mind, that *dilution of a fluid containing the*

\* Comptes Rendus, lxxviii, 1868, and lxxi, 1871.

*specific cause of a disease lessens the chances of communicating that disease when the fluid is brought in contact with the body.*

#### HOW CAN TYPHOID FEVER BE PREVENTED?

If the evidence which I have presented is conclusive, the reply to the above question may be stated in four words, namely: *Stop drinking contaminated water.* This might not prevent *all* the typhoid fever; but it would appear that by far the greater proportion of it in Michigan may reasonably be expected to be thus preventable. How to prevent the contamination of the various water-supplies cannot be so briefly stated; but if people care enough about it to take the necessary trouble to do this, sanitarians can tell them how. So far as it relates to typhoid fever, it *may* be that all that is necessary is to destroy and keep out of the water all discharges from persons suffering from typhoid fever; but the difficulty of recognizing the disease early enough in its course is so great, that in order to do this it will be necessary to keep all human excreta, and perhaps the excreta of some animals, out of the water-supply. Most people think they do this now, or probably we would not have, as we now do, about a thousand deaths a year in our own State from this cause; but I think we have reason to believe that their confidence in the purity of the water they drink is misplaced, and that consequently many of them sicken and die. The numerous instances where typhoid fever has apparently been caused by drinking-water contaminated by decomposing *vegetable* matter, indicate that, even if the cause of the disease is specific, until such time as that the specific cause shall be so restricted as not to find access to water-supplies, it is important to preserve the water from contamination by vegetable as well as by animal matter.

Dr. J. H. Kellogg, of Battle Creek, member of the State Board of Health, then followed with an address on the Disposal of Waste Matter.

#### DISPOSAL OF WASTE MATTER.

BY J. H. KELLOGG, M. D., OF BATTLE CREEK.

(Abstract by S. G. Higgins, Stenographer.)

A scavenger is not considered a very choice member of society. His business is beneath that of every other person, unless it be that of a hangman. Unfortunately, too, he carries on his business in the night, when the bad odors naturally remain near the ground. But we ought to treat the scavenger as a public benefactor.

I understood my subject to be the disposal of decomposing organic matter. Of course, you have all heard of germs, or bacteria, as they are otherwise called. Decomposition is the process by which all living things go back to dust, and germs are the agency by which this change is brought about. They are microscopic creatures, of many varieties, and they set up the process by which vegetables and animals of all sorts are reduced to the elements of which they were originally composed. Certain conditions are necessary for decomposition to take place. The temperature should be about 100 degrees; and in order to check decomposition the temperature must be reduced nearly to the freezing point. If a piece of decomposing matter is heated long enough the germs will be killed, but no amount of cold will prevent germs from reviving when the proper heat is again applied. Cess-pools and sewers are among

the most dangerous sources of decomposing organic matter. Old wood-piles, garbage heaps, sour milk in the pantry, dirty dish-cloths hanging around the kitchen, etc., are examples of the more common sources. Where these obnoxious things are under our own control we have no excuse for allowing them. But too often they are the results of the uncleanness of our neighbors. These germs from decomposition are carried into the air, into the water, and into the ground about our dwellings, and thence into our wells of water. Often the ground air, which is drawn into a house by the drafts of the chimneys and windows, brings with it a mixture of these germs when they are in the soil near the house.

The great question is, how shall we dispose of this decomposing matter? It may be removed, it may be destroyed on the premises, or its decomposition may be arrested or prevented. The two principal ways of removing waste matter are by the dry-earth system and by the sewer system. The dry-earth system is very successful when properly attended to. But a scavenger should be employed to look after a number of houses, as no one house can be successfully attended to by the occupants, for not having that business to look after specially, the closets will be neglected. The sewer system requires thorough ventilation; otherwise, traps are of little use. The best way to destroy decomposing matter is to burn it. If it is spread out thinly over the surface of the ground the oxygen in the air will in time burn out the impurities. But it should not be spread out near the dwelling or well. Then there are various chemical disinfectants. These are made use of largely in sick-rooms. But no sick-room can be properly ventilated and disinfected while the patient remains in the room. The process should be so thorough that a human being could not live in the air while the disinfection is going on.

The Convention then adjourned until Wednesday morning at 9:30 o'clock.

## SANITARY CONDITIONS AND NEEDS OF SCHOOL BUILDINGS AND GROUNDS.

BY PROF. C. B. THOMAS, SUPT. SAGINAW CITY SCHOOLS.

This topic has been so often and so exhaustively discussed in gatherings similar to this, that one may well despair of saying anything new upon the subject or even of putting an old idea in more fitting dress. One thing perhaps should be distinctly said in the outset, and it is just possible it should be said from the side of the schools themselves.

The air is full of arrows aimed at the public schools. The church prelate, the mental philosopher, the friend and the foe of the Bible, the L. M., the social scientist, and the medical practitioner each bends his bow and lets fly his shaft with a purpose and vigor all his own. Some are friendly shots to windward, inviting us to heave to for examination and consultation; others are dipped in gall, intended to pierce, poison, and destroy. Why are we thus become a target for every craft on the social seas?

It must be admitted that the public school system of the United States is a large institution. It includes a grand host of earnest and intelligent men and women who occupy every city, village, hamlet, and clearing from Maine to Oregon, from the great lakes to the gulf. They are organized as no other band of workers, professional or political, ever were, or perhaps ever can be. Teachers' institutes, Normal schools, county, State, and national associations have

for a quarter of a century drawn them closer and closer together; a common purpose, common methods, and identical conditions have cemented the union till they have become a modern phalanx, marching with even and almost irresistible tread. Such an organization, touching every family and every interest in the land, must have enemies as well as friends; will meet sometimes with plaudits, sometimes with curses.

The common purpose of this organization is the intellectual training of the young, incidentally supplementing home culture in morals and conduct. This singleness of purpose, which has been the strength, is now, possibly, a source of weakness in the system. Thinking of the mind, we have, possibly, to some extent forgotten the body. Seeking to develop the faculties of the intellectual, we may have overdrawn our account and subtracted from the resources of the physical organism.

If we have discounted the spine, muscles, and lungs for the benefit of the brain, it has been done unconsciously. Our sins, if any are recorded against us, have come through inadvertence, not through purpose, they are of omission, not commission. And we shall welcome most heartily any light that can show us a better way, any suggestion how best to repair discovered errors. Therefore, however thick the arrows fly, we shall welcome those sent to windward, inviting us to an examination, to careful investigation of conditions and tendencies.

I wish, most emphatically, to disclaim, in behalf of school men, any hostility to scientists and experts who seek to examine into any phase or condition of school life. Especially shall we gladly join hands with those who seek to remove causes of disease, to keep the ordinary channels of child life free from corrupting influences, to build a sound body for our sound mind.

Not many years have passed since such a gathering as this was among the things expected. Not long ago the highest test of civilization was due care for the helpless and the wronged; this was Christian charity. But it is one step higher when we take precautions against possible helplessness and wrong; this is Christian philanthropy. It is a high duty to aid those injured by ill-regulated institutions; it is a higher duty to regulate and reform the institutions themselves.

The sanitary conditions affecting school buildings and grounds are divisible into two classes: 1, the natural, and 2, the artificial.

The natural conditions concern the site, the location, malarial surroundings, as affected by: 1, elevation; 2, drainage; 3, light, and 4, air.

No building to be occupied by lower animals or human beings should be placed on low, wet ground, without either natural or artificial means to better its condition. For school buildings, sites should, if possible, be secured having reasonable elevation sufficient for natural surface drainage, convenient for artificial under-drainage, and the former is rarely so good as to render the latter unnecessary. But because a sufficiently elevated site is recommended it by no means follows that the highest elevation is the most desirable. In the Saginaw valley this is indeed the only rule that applies, for here the highest is scarcely sufficient; but some cities in the State have crowned high bluffs with three-story structures, necessitating a long and often injurious effort for both teacher and pupil.

Some States forbid by law the opening of a saloon within one-half mile of a school-house; at least an equal distance should separate the school-house from stagnant waters and fever-breeding low lands. Fortunately most school-houses are built apart and the light comes to them unobstructed by contiguous

buildings. They are, however, sometimes set in dense groves where trees and foliage cut off light, hold dampness, and engender unhealthful conditions. These spots are often beautiful, and in July and August, when there is no school, are delightful retreats; but in late fall, and in early spring, must be regarded as sources of possible peril.

But the dangers lurking in artificial conditions are more numerous and far more insidious. The unhealthful natural conditions alluded to are palpable, and appeal to common sense and practical experience. Artificial conditions are of our own making, and most difficult of correction. They grow out of transmitted habits, customs of previous generations, slow and unwilling assent to new ideas, and an ignorant economy that would save dollars and cents at the indirect cost of comfort, health, and life. To discover these insidious sources of disease, to convince people of their dangerous and destructive nature, to persuade a sluggish and indifferent public to remove them, at any cost, for the sake of humanity, is a long, a herculean task, but a necessary, a noble, and a beneficent one.

Ideas of school architecture have undergone radical modifications within recent years. Seven years ago, in this city, before hundreds of teachers and citizens, in a paper on "Educational Fallacies and Forces," I made use of the following words: "The methods and appliances of the school should be so arranged that the effort to secure intellectual strength shall not induce physical weakness. Elevation of the body is not necessary to activity of thought. Every observant teacher, and thousands of disappointed parents, will unite in condemning three and four-story buildings. The proportion of young women, graduates of our public schools, who go out with pallid cheeks, with eyes underscored with purple curves, with headaches and backaches, unable to stand or walk, is something to make us pause. It is the work of a one-horse power engine to lift 32,000 pounds one foot per minute. A half dozen young girls lifting themselves to the third stories of what are sometimes called educational slaughter-houses, are forced to do, several times each day, about the same work.

"Unquestionably this is an important subject; the attention of thoughtful persons is being directed to it, and the days of three and four-story school-houses ought soon to be numbered. What Michigan city will be first to build a low high-school, and thus lead a much needed reform?"

These few sentences provoked a stormy debate, and a large majority rushed to the defence of the high high-school. But that was not the final verdict. The discussion took wider range among abler disputants. Since then the high-schools in both Saginaws have come to the ground. Saginaw city has just built a fine new 8-room house, at a cost of about \$15,000, for the sole purpose of entirely vacating her only third story, and the recent history of school-house erection all over the land shows that the days of three-story school-houses are numbered.

Much stress has been laid by many upon the cubic feet of space each pupil should have in the model school-room. It is not easy to determine, for the problem is not simple, but several times compounded. The additional elements are the heating apparatus, provision for inflow and outflow of air, the length of sessions, and perhaps still others.

The average school-room contains, or should contain at least 10,000 cubic feet of space, if occupied by 40 pupils. A person by breathing adds  $1\frac{1}{2}$  of carbonic acid to  $55\frac{1}{2}$  cubic feet in an hour, or would vitiate to this extent nearly 1 cubic foot a minute. Multiply this by 40, or the number of pupils in the

room and we have 40 cubic feet of air contaminated each minute by foul breath alone. Besides, subtle streams of effete organic matter are constantly exhaling from the lungs and skin, and rank effluvia from many unwashed garments, stiffened and polished after a manner known only to the school-boy. Figures may as well be omitted, and the whole matter summed up by saying, all the fresh pure air that can possibly be circulated through a school-room without creating dangerous currents, is an absolute necessity.

East Saginaw and Saginaw have each just completed a new building on this *ad libitum* estimate. Huge furnaces are set directly beneath the rooms. Warm air rises to the rooms in separate perpendicular flues, and like great arteries, carries abundant supply of the vital fluid. Veins of outflow are provided under each window, through which the impure air is drawn off under hollow floors to a central heated exhaust and discharged from the building. We expect to change the air of the rooms completely every fifteen or twenty minutes; and if anytime they become too highly heated they can be rapidly and safely cooled down without opening a window or a door, and without interrupting the outflow of impure air.

The sources of impure air in the school-room, other than the breath, lead inevitably to the consideration of the subject of personal cleanliness. It is a delicate subject in a convention, though sufficiently indelicate in the school. The carbonic acid of the breath may be more poisonous, but it is far less noisome and sickening than the effluvia from little bodies long innocent of the bath, and from garments, outer and under, sticky and stiff with the foulness accumulated in a period extending from newness to final dropping in decaying shreds. It is sometimes seriously proposed that a medical expert shall be appointed to examine pupils on entering school, and from time to time during attendance, to determine their fitness for school work in respect to sight, hearing, and general health. If such an officer shall ever be appointed, and I see in the suggestion no incongruity, impolicy, or unwisdom, we ought to pray that his jurisdiction extend to cleanliness, with full power to protect the primary schools from an almost intolerable nuisance, and an actual source of danger.

Much has been said at various times upon the subject of cross-lights, and their injury to eyes. And a recent essay before this body has gone so far as to urge the admission of light from only one side of a school-room. But the author apparently fails to see that, according to his own rules, it would be practically impossible to get the requisite amount of window opening from one side of the ordinary school-room. However, if possible, this seems to me, in the light of long experience, a plan of doubtful utility. The dimensions of the ordinary school-room would make the sittings of many scholars too far from the windows, if they were inserted in only one side of the room. On dark days, and in the late hours of winter afternoons, 25, and often 10 feet, is too far from the source of light. The effort to read in too little light is as likely to be injurious as the same effort under cross-lights. Besides, the injurious effects of these cross-lights is easily remedied by a discreet use of curtains. In the new building about completed in Saginaw, light is admitted from two sides, always from behind and from the left side of the pupils when seated. Blackboards will entirely surround the room, even between the windows, because the blackboard space is of vast importance to the work of the room. But, as pupils will never sit facing a contiguous blackboard and window, no annoyance or injury from their nearness is apprehended.

And now, in conclusion, let me touch upon one more topic, the point of the greatest number of assaults from without the schools, and perhaps of the most sensitiveness within them—the courses and the hours of study. These are the Redan and Malakoff of the situation. Hear the cries that go up from many sources: "Teachers are killing pupils with excessive study; study and recitation all day; study till the late hours of the night; study again in the early hours of the morning," says one. "They are building brains and killing, slowly killing, bodies," says another. Even Dr. E. E. Hale, in the November *North American Review*, would cut the attendance in school down to half time, and have half the time spent at home in every-day work. The *Scientific American* thinks "two-thirds of our work might be wiped out and abolished to the benefit of our children."

There may be stagnation in some branches of productive business, but the output of the educational grumbler regards not hard times, neither fears protective duties. Most of these shafts, dipped in gall, are aimed primarily at the school system, secondarily at the teacher. And, as the system like a corporation, has no soul, while the teacher has, he is the only one actually hit and hurt.

But these grumblers should be more considerate. They should show better knowledge of educational history. Who put the leaven into the educational meal? Who kneaded, moulded, tempered, shaped, and perfected the educational system of the United States? Who are its parents and sponsors who stood by the font when it was baptized into the American household? Not alone the teachers of yesterday or to-day. Not the school officers of any generation; not the statesmen of any administration. It is a growth. It is indigenous to American soil, it has its roots in American life, draws its blood from the American heart. It is the people's. They have made the system what it is, because, in their judgment, the times, the institutions, the conditions demanded such a system.

When parents see that their children are dying from hard study in school, parental love will see to it that the children are kept out of school. But is it true? Has anybody shown, can anybody show, that young people in grammar and high-school, as a class, are in lower condition physically than those engaged in domestic duties or in shops and factories?

From long observation I am convinced that children in school to-day are demonstrably in better health than those who are employed in shops and factories or running at large upon the street. And beyond all question they are as well off as to morals and conduct.

As to hours of study, teachers do not fix them. We are but hired servants and we hold school such hours as are prescribed by parents, through their chosen representatives, the official members of boards of education. Any effort on our part to secure reduction of hours would subject us to the charge of seeking lighter duties for selfish purposes. These have been shortened, since the golden days the complainants love to remember, by the abandonment of Saturday; lessened just one-sixth.

And no man who visits the schools, or labors in them long enough to know the general facts, will denounce the schools for excessive work, over hours, or general destructiveness.

This point was ably argued before this body by Supt. Perry, of the Ann Arbor schools, two years ago, and I need not attempt to add to that argument here. We, as teachers, are far from claiming perfection for schools as now

organized. For their methods we hold ourselves responsible. But if organization is to be assailed, and the amount of work is to be condemned, the assailants must train their guns upon the people, including themselves, who built this as they have the other institutions of the land. But we, as teachers, believe these complaints of over-hours and excessive study can only be founded on isolated and exceptional cases. They are abundantly disproved by wide observation in the schools themselves and by the universal support of and confidence in them evinced by an intelligent public.

The discussion on this subject was very interesting and was taken part in by Prof. Vaughan, of Ann Arbor, Dr. Harriet V. Brooks, of East Saginaw, and others. Prof. J. C. Jones, Supt. of East Saginaw schools, was expected to lead in the discussion; but was absent from the city, and therefore unable to do so.

Dr. Vaughan thought that study was no injury to health if the physical system was properly cared for. He regarded it as firmly established in sanitary science that intellectual labor is absolutely necessary to bodily health. He thought the schools should be closed as early as the fifteenth of June, and not be opened until late in September, after the hot weather had subsided. Dr. Kellogg expressed similar views. Mr. Webber thought there was no danger from over-study if the stomach was not over-loaded, and if the hours of sleep were not cut short.

Rev. W. A. Masker then read the following paper:—

## CO-OPERATION OF CITIZENS IN PREVENTING THE SPREAD OF DISEASE.

BY THE REV. W. A. MASKER, OF EAST SAGINAW.

The most carefully framed laws are powerless, in themselves, to bring needed good, or to avert dreaded evil. The wisest of sanitary regulations will surely fail to stay the ravages of disease and to keep danger at the minimum unless an enlightened public sentiment give force to that which the authorities have decreed, and aid them in carrying their rules into effect.

Upon the topic assigned to me I write as a layman, responding to the call for such facts and suggestions as I may be able to give. On its scientific side the subject must be treated by professionals. I shall make no attempt in that direction. But those who hold positions which give them some chance of influencing the minds and actions of others may not excuse themselves from duty, though it happen to lie outside of their usual routine. In addition to the statement of some facts which have been called for, my words will be spoken on general principles, rather than otherwise.

I came to this city in May, 1881, as rector of St. Paul's church, and soon learned that for some time previous thereto the community had been suffering from the ravages of scarlet fever and diphtheria, both in epidemic form. Many deaths had occurred, and several families had been left almost childless by the effects of the dreadful visitation. In my own parish, for a time, the deaths succeeded one another with startling rapidity, so that I sometimes, on Sunday, looked into the faces of children whose bodies I placed in the ground before the week ended. The disease of which I saw the most was diphtheria; and though I was called to minister in various parts of the city, I soon learned that one particular locality was suffering in an especial manner. The experience was somewhat novel to me, and I wished to discover, if possible, some reason for the evident tenacity with which the disease held to the locality indicated. I do not say that I discovered the reason. I only know, applying principles which physicians have taught me, that, in some cases, so called

"mysterious visitations of Providence" were rather the sure results of human improvidence. I shall carefully conceal names, and change dates, to avoid wounding again the hearts of some of those stricken parents and friends with whom I stood in the hours of their great affliction.

One day, I will say early in June, I was called to go and baptize a dying child. I found three other children in the house recovering from severe attacks of diphtheria, and the one which I baptized died a few moments afterwards, almost under my hands, and while I was still there. Before I left, several neighbors came in and went about the rooms and into the chamber of death, as though no danger were to be apprehended from their conduct. The next day I went to the funeral in the same house, and found not less than twenty persons present, some about the open doors, and some within the house and around the coffin and mingling with the family. I do not know what measures, if any, had been taken for disinfecting the premises. Exactly fourteen days afterwards I was asked to bury a girl sixteen years old, who had been permitted to enter the house where this child died, sometime during the day on which the funeral occurred. Within three weeks of the death of the sixteen-year old girl, I ministered in three other families in which children had died from the same disease, and, on each of the occasions, persons were present from families representing several children each; and I ascertained that some individuals from all three of these households in which deaths had latest occurred had visited the two houses first above referred to, during the sickness of the children there, or after they had died, and previous to their burial. In each case I privately protested against the presence of any persons whose services were not needed. In regular succession, I was called to six or seven other houses in the same quarter of the city to bury children, and on each occasion found several unauthorized persons present, who had children at home to be endangered by their rashness. In some of the instances named the disease had existed in different families simultaneously, and in others successively. In every case after the first cited, judging from what I saw and could learn, no reasonable doubt was left in my mind that the germs of disease had been carried, through carelessness and disregard of law, from one habitation to another, and that both disease and death were, humanly speaking, needless.

In the same year, in another part of the city, I traced the disease from one house to two others, in all of which deaths had occurred, and, as I believed, the result of the needless intermingling of friends and neighbors with families in stricken households. Not far from the same time I also traced scarlet fever from one house to two others into which I believed the deadly germs had been carried either during the progress of the disease, or after the death of one child which I buried. On one occasion a little girl died of diphtheria, and the doll which she had handled during her illness was given to another child that I buried three weeks later.

I have said that I protested against the presence of unauthorized persons in stricken families. I declared on several occasions that I would not attend as a clergyman to minister to the sick or to bury the dead, "unless the presence of such persons should be prevented. I conferred upon the subject with the police, with the undertaker, and with the health officer, who did all in their power, I have no doubt, to prevent anything like public funerals in these several cases; but their efforts were powerless, as mine were, to prevent the needless running to and fro before and after funerals, and while the danger of

infection existed. It should be added here that when, as happened, it became possible to enforce stricter discipline in this particular regard, the scourge was abated. People seemed to learn, at last, that any needless approach to the disease should be avoided. I speak, of course, of those concerning whom I knew the most.

Without trenching upon professional ground, I have a few words to add. All ordinary sentiment is ill-bestowed in times of danger. Ordinary courtesies and rules of politeness are abrogated by the stern law of necessity in the presence of communicable disease. A new code goes into effect there, the most careful observance of which is demanded for the good of society and of the particular community. In the absence of a health officer, the attendant physician should be an autocrat, whose word should be inflexible law. Visits of condolence, and those prompted by idle curiosity, should be forbidden and absolutely prevented. People should be made to understand that when they go needlessly into danger for the mere showing of a kindly spirit, they are committing a crime against their own households, and against the community in which they dwell. And those who are afflicted should understand that the absence of all ordinary courtesies affords, under such circumstances, no occasion for offense. To do a thing when it is needless and in any sense dangerous, is not the same as the doing of it when it is necessary. An unwarranted "scare," so called, is unmanly and unwomanly on the part of any; but wise caution and prudence are ever demanded for the safety of the unsmitten. The poison of disease is no less deadly because it happens to exist in the person of our dearest one. A mother said to me after her child had died, when I demanded the exclusion of needless visitors from the house: "Why, my dear baby would not hurt any one!" And yet, in all probability, her baby had died because she had done, in another case, that which I forbade others to do in her time of affliction. The sick baby, and the dead baby, and the garments and the toys, and the very house are poisonous until the poison be removed or destroyed. Personally, I go into the presence of all diseases, as the doctors go, when duty calls, and use all possible safeguards, while there, and afterwards, and never fail to think of those to whom I would not for worlds convey the seed of disease. Duty is one thing; simple politeness is another; and we can well afford to dispense with the latter until danger is past. The same precautionary law which forbids public funerals for those who have died of a communicable disease, should as certainly forbid all those needless attentions which facilitate the spread of disease. The number of attendants upon the sick should in any case be as small as possible, and so far as may be should consist of those whose personal ties are the fewest, and whose ordinary duties are the lightest. Especially should this be the rule as concerning those who go into the presence of communicable disease. The well children in the house, for their own sake and for the sake of others, should, to the farthest extent possible, be removed from contact with the diseased; and those persons who pay attention to the sick, or to the bodies of the dead, should ever remember that the utmost caution is needful as they go thence into contact with the living and the well. As the physician should be an autocrat, so his advice should be sought and followed to the letter whenever he announces the existence of danger; and if this be done the spread of disease may be greatly restricted. Indeed, I deem this rule of more importance than any other which occurs to my mind. Any seeming harshness in the enforcement of wise sanitary regulations is really disguised kindness. The ill and the dead are not

loved less because measures are adopted for the safety of the living and the well.

I am impelled by the result of extended observation, to add, in a single sentence in closing, two further suggestions. The consciences of the people need to be instructed upon the subject we are considering. It should become a matter of duty with all to use those safeguards which the authorities ordain against the spread of disease. It is true in every human relationship that no man lives unto himself. We are all parts of one great body. The laws which we are asked to obey for the sake of others are observed no less for our own sake. Their observance should not be dependent upon our preference or inclination. The appeal comes to us as concerning the right. But the conscience can only be instructed as knowledge upon the whole general subject is disseminated. Toward the spread of that knowledge we may all do something in our way. What our duty is I hinted at in the opening of this paper. The State authorities are powerless in the premises without the efforts of local boards; and local boards must be powerless, or largely so, without the coöperation of all good citizens. We hail this convention as an omen of future good for our city—good to be realized as the masses of our people resolve that it shall be realized.

In the discussion which followed the reading of the Rev. Masker's paper, Rev. J. T. Oxtoby and Rev. T. M. Shanafelt reported similar experiences. Rev. Franklin Noble thought he had been able to trace the contagion in some cases, but, coming to the city later than the epidemic mentioned in the paper, he had found the citizens quite careful to avoid aiding the spread of disease. It was thought that there was improvement in this respect. Mr. Webber wished that the paper of Mr. Masker might be printed and placed in the hands of every citizen of Saginaw. Dr. Brooks said that if there were improvement in the manner in which citizens coöperated with health authorities, as was probably true, the credit should be given to the State Board of Health, which was one of the most efficient of its kind in the United States, and had done much toward educating the people in this important matter.

She called attention to another disease not always considered contagious and seldom treated as such, namely, tuberculosis or consumption. Recent researches in Germany have left it almost beyond question that the disease may be communicated from person to person; and almost every one has seen whole households destroyed by it, even when all the members were not related by ties of blood, to favor the old theory of heredity. Patients sick with this disease should be isolated from others to the extent, *at least*, of occupying separate sleeping rooms.

Another case in which the coöperation of citizens is very important is in the prevention of the spread of Asiatic cholera, which is very likely to appear in this country next spring.

Two theories are entertained in regard to the origin of the disease: One, that it is caused by a specific poison, always appears first in India, travels westward along the lines of rail and water travel, and is spread only by contagion. Against this mode of introduction we hope to be protected by the government, acting through its health officers, and by means of quarantine regulations.

The second theory is that cholera may be developed wherever favoring unsanitary conditions and habits exist, and against this danger we must be to some extent our own protectors. In Naples, Italy, during the epidemic of last summer, the disease was almost confined to the very poorest quarter of the city. Here the streets are narrow, unpaved, and wet, and the buildings on each side so high that a ray of sunlight rarely enters. The dwellings are crowded with tenants whose habits are most uncleanly. When the deaths from cholera had begun to grow less, there was a sudden and alarming increase following several days of cold rain and thought to be due in part also to the celebration of a festival at which the people indulged in large quantities of new wine and ate excessively of unwholesome food, unripe or stale fruit, etc. In Genoa, Italy, on the contrary, the epidemic visited the better portions of the city, but was found to be caused by the water which was brought by a certain aqueduct from a distant river, on the banks of which was a village suffering from cholera, and in the water of which the clothing of cholera patients had been washed. Cutting off this supply and furnishing water from another source had the effect of checking the epidemic.

The lesson we may learn from these facts is that all unsanitary conditions should be corrected before the arrival of warm weather, and that we should make up our minds to live temperately and healthfully, and so avoid the terrors of an epidemic.

Dr. Victor C. Vaughan, of the State University, member of the State Board of Health, then gave a long and interesting address on Adulteration of Foods, of which the following is a brief abstract:—

## ADULTERATIONS FOUND IN COMMON FOODS.

[Abstract of Dr. Vaughan's Address.]

A great deal of nonsense has been said about adulterations in food. A great many over-statements have been made, and the public has been needlessly stirred up on the subject. However, adulterations in food are more extensive now than at any other time, and the reason is that the consumer persists in demanding a cheap article. For example, there is used in this country about six times as much "Madeira" wine as there is made in Europe, and more "Champagne" than is manufactured in the whole of France. A second cause of adulteration is the desire on the part of the vendor to make his goods look as well as possible, and a desire on the part of the buyer to buy the best looking goods. There are three classes of adulterations, (1) those that are deleterious to health, (2) those that are fraudulent, and (3) accidental adulterations. The mistake which the legislator makes in dealing with this subject is that he treats all three classes alike. Then, in this State, our laws provide no method of carrying their provisions into practical effect. Fortunately, the deleterious adulterations are not very numerous. Their vendors should be punished criminally. The fraudulent adulterations are by far the largest class, and the remedy here should be a suit for civil damages for not delivering such goods as were bought. Of course, no one is responsible for accidental adulterations, unless the vendor knows of the adulteration when he sells the goods and says nothing about it. It then becomes fraudulent.

(Doctor Vaughan then went over a list of various articles, stating the way in which they were frequently adulterated, the following being a partial list:)

## ANIMAL FOODS.

	<i>Deleterious.</i>	<i>Fraudulent.</i>	<i>Accidental.</i>
Meat .....		Flour, meal, fuchsin, salicylic acid, borax.	
Canned Meat.....		Flour, meal, fuchsin, salicylic acid, borax.	
Butter .....	Copper.....	Water, salt, fats, colors...	Curd.
Cheese .....	Mercury, arsenic.....	Fat.....	Decomposition.
Milk .....	Water.....	Soda, salicylic acid.....	Sand, dirt.
Lard .....	Lime and alum.....	Starch, salt.	

## VEGETABLE.

	<i>Deleterious.</i>	<i>Fraudulent.</i>	<i>Accidental.</i>
Bread.....	Alum, Copper.....	Other flours, water.....	Ashes.
Arrow Root.....		Other starches.	
Flour.....	Alum.....	Other starches.....	Sand, iron.
Sago.....		Potato starch.	
Sugar.....	Tin, lead, gypsum.....	Glucose and rice.....	Sand and dirt.
Coffee.....		Chicory, peas, beans, acorns, chestnuts, shells, burnt sugar.	
Confectionery.....	Colors.....	Glucose, terra alba, gypsum, flour.	
Cocoa and Chocolate.....	Iron, colors.....	Fats, starches, flour, sugar.	
Ginger.....		Turmeric, mustard, pepper.	
Honey.....		Glucose, cane sugar.....	Pollen.
Isinglass.....		Gelatine.	
Canned Fruits.....	Aniline, essences.....	Gelatine, apple jelly.	
Mustard.....	Lead chromate.....	Tubes flour, turmeric, cayenne.	
Horse-radish.....		Turnip.	
Pickles.....	Copper, Alum.		

Preserves.....	Aniline.....	Apples, pumpkins, molasses.
Pepper.....		Flour.
Spices.....		Flour, starch, peanut shell.
Cloves.....		Starches.
Tea.....	Prussian blue	
Vinegar.....	Acids.....	Caramel.
Brandy.....		Alcohol from other sources, glycerine, catechu.
Wine.....	Aniline, brandy.....	Water, Sulphate of Potash.

The convention then adjourned until 2 P. M.

## THE SEWERAGE AND DRAINAGE OF EAST SAGINAW.

BY CHARLES HOLMES, C. E., EAST SAGINAW.

I have been requested to prepare a paper on the sewerage and drainage of East Saginaw—a kind of improvement which has been the chief factor in placing this city in the fair sanitary condition in which it now is—but I regret that my engagements abroad, at this time, will not allow me to do the subject the justice it deserves.

In the main, the sewerage and drainage of this city differs little from that of other cities of recent origin. Planned originally on a scale that was considered too costly for pioneer days, it was remodeled by the first engineer who took charge of the work, and the first acting sewer commissioner, who was also an engineer, to better suit the exigencies and resources of the time. So far the system has proved itself to be adapted to the needs of the people, and it will remain so, at the present rate of increase, for many years to come, while it has contributed in no small measures to their comforts.

The plan is simple and effective. The city is divided into districts, each having its main sewer discharging direct into the river. In both the main and lateral sewers side junctions, of six inches diameter, for house drains, are provided on either side at an average distance of thirty feet apart. Catch basins are placed at every point necessary for surface or street drainage, and manholes are built at intervals sufficiently close to allow of the locating and removal of any cause of stoppage. The form and size of the catch-basins are especially adapted to this locality, whilst they are substantially built and efficiently sealed. The manholes, too, are well sealed by close fitting iron covers, a method of construction that will, I judge, commend itself to some sanitarians as superior to perforated covers, used in other cities, which allow the escape of sewer gas into the streets.

The sewers are built with a view to permanence, ordinarily of eight inch work of the best common hard brick this market affords, laid in Akron or Louisville cement, and only in soft bayou bottoms has it been found necessary to lay special foundations and walls. The pipe used in lateral sewers—from 12 to 24 inches diameter—and those in house drains are required to be of the first quality of their respective kinds.

I do not propose on this occasion to review all the details of structure, believing it to be sufficient to refer only to such features as may be considered to affect favorably or otherwise the sanitary condition of the city.

The catch-basins of sewers, as you are aware, are constructed only to carry off the surface water from the street. It was not until a late day, however, that some of our people discovered their legitimate use. They got to be such intolerable nuisances, in the most populous part of the city, by being made to

serve as the receptacles for filth that the sewer board at last caused notices to be circulated throughout the city threatening with prosecution any person caught polluting them. Slops from bedrooms, the washings of spittoons, and the gas water pumped from the gas syphons were thrown into them. But happily to-day this practice is discontinued and thereby one source of disease removed.

The removal of the cause of stoppage in house drains in the early period of our sewer building revealed the original ideas held of the capacity and use of such drains. Hoopskirts, collar boxes, old boots, etc., were among the incongruities found in them, but in time the idea became prevalent that a six or nine inch sewer pipe had not the capacity of, or any communication with, a second-hand clothes store.

The successes and failures attending the costly and elaborate systems of Paris and London have taught us many principles that should govern the construction of sewers. Forms, sizes, and gradients were formerly the most varying factors to be dealt with, but experience has shown what are the most desirable in this regard, under certain conditions, so that this branch of engineering is fast becoming an exact science. No more important feature presents itself in framing sewerage plans for a city than this matter of size and gradients, and notwithstanding that most of our district plans were made as early as 1866, the system, as far as it is to this day developed, has proved in all its structural details a complete success.

The total length of public sewers laid in this city, to date, is 74,976 feet, equal to 14.2 miles; the number of manholes built, 589; and catch basins, 420. Estimating the distance apart of the embranchments through which house drains discharge into the sewers, at thirty feet, gives a total of 4,998 available at the present time. Official records show that only 644 private drains have been built to the public sewers—not a satisfactory showing considering the house drainage facilities offered. Some were made compulsory to abate nuisances, but most of them are the voluntary acts of householders.

The board of sewer commissioners dictate the size and character of privy vaults which drain into the public sewers; and it is made the duty of their engineer to see that property owners comply with the rule of the board governing such structures. But this regulation as well as that (strictly observed by the board) requiring a close inspection of the laying of all drains to the public sewers, as far as the lot lines, is made as a measure of protection to the public sewers rather than for sanitary reasons.

The most grave unsanitary condition which exists in the system is the non-ventilation of the sewers, and the remote periods at which they are flushed,—so remote that it has faded from the recollection of the man who did it. From the “dead end” of every lateral sewer to its outfall no escape of accumulated gases is possible as far as the public sewers are concerned, and the only point where it might possibly escape, if certain forces were not existing within the sewers to prevent it, is at the river at the outlet of the mains. The question naturally arises: What becomes of the sewer gas? I do not know. As far as my knowledge goes all soil pipes are properly trapped, but only in a limited number of cases is an outlet of any kind provided for foul air. The character of the hidden work of house drainage is known only to the owners and the men who execute it—a wholesome and good sanitary condition of the house depending entirely upon their judgment. It is for you, gentlemen, who have a knowledge of what constitutes good sanitation, and how it is effected,

to judge if it is at all possible that immunity from danger depending on such a contingency is always realized.

The rule of the sewer board, as I said before, requiring their engineer (or some other competent person) to inspect the laying of house drains from the public sewer as far as the lot lines, has been strictly observed, and in some instances the owners have engaged an engineer to inspect the work to its final completion. Thus careful laying and tight joints are assured adjacent to the sewers, where the condition of the ground is favorable.

It will, I think, be conceded by those who are familiar with the way house drains become leaky and inoperative, that a reliable foundation is as necessary as good material and careful laying. The material with which a considerable area of the business part as well as some of the residence part of the city, is filled in order to raise it from its original low level to the grade as now established, suggest the necessity of looking well to the foundation of house drains so as to reduce to a minimum the danger of fractures and leaks. It has been the practice hitherto, within the limits of these soft areas, to lay the drains below or through the foundation walls of the building, and in many to extend them under the basement or ground floor. The settling of buildings in these situations have been frequent. The question is, therefore, pertinent: What might an inspection of drains so laid reveal? It is always objectionable, from a sanitary point of view, to lay stone-ware pipes under basement or ground floors in any kind of ground. Cement joints are apt to become leaky, and, if they do not become so, they are pervious to sewer gas. Since it is not possible to get material for sewer drains that will accommodate itself to the uneven settlement of filled ground without breaking, the remedy lies in the use of iron pipe [for drains, that must be carried under buildings, attached to the foundation of a building previously secured from possibility of settlement.

That the construction of our public sewers has been beneficial to the health of the people, and that the system has been worth the money to carry it out, is conceded on every hand; but the necessary data are not available to determine to what extent the sanitary condition of the city has been improved, by the removal of preventable causes of disease, in the several sewer districts. The class of facts most valued by this convention would no doubt be those which would show the general status of health at the time of no sewers, and the degree in the scale of improved health to which the people have risen since the introduction of our sewerage and drainage systems. Available and necessary statistics, covering the earlier periods of the city's sanitary history, are too meagre to be of any value, so that one is remitted to a bare statement of results, unsupported by figures, and based purely upon personal observation. The progress of sewerage in the earlier days of its introduction was necessarily slow, and confined principally to the removal of stagnant water from low surfaces as preliminary to filling them up. The steaming up of miasmatic vapors (to say nothing of the varied stench which arose from these sloughs), the shaking of the inhabitants with tertian ague at the rate of 120 to the square acre, and the ringing of church bells at preconcerted intervals to notify the sick when to take quinine, are all things of the past. A large area of the business portion of the city covers this whilom offensive surface, now entirely drained and filled; and its worst traditions are fast fading from memory, while in the main, the *habitués* of the locality seem to live long and prosper. The sanitarian seeking to cure existing sanitary defects in this part of the city has now a comparatively easy task, since natural faults of unfavorable site have been obliterated.

Briefly stated, the public functions of the sewerage have been fully carried out in our system, and it is to be hoped that the serious omission to flush and ventilate the sewers, where needed, will soon receive the attention of the public authorities. But notwithstanding this sad fault—sanitarily considered—our public sewers, it can be fairly said, have been judiciously planned, well and honestly built, and the development of the system conducted on a basis of rigid economy. The private functions of our sewerage system have developed rather slowly, and the intelligent and discriminating among our citizens feel that our sanitary requirements are such that the aid of the authorities should be invoked to make it obligatory on every owner of property, when the sewage is completed, to construct at least one water-closet and connect the same with the public sewer. The records of the sewer board which I have quoted certainly indicate a very limited appreciation of the advantages offered by the public sewers to remove excreta to its legitimate and proper receptacle, and it is no exaggeration to say that for every drain connection made with the public sewers an old-fashioned privy, with its unsavory pit, is built, which keeps up a perpetual contamination of the soil. I do not know whether law or ordinance requires that these receptacles of filth shall be excavated to a definite depth or not, and I ask your indulgence for not informing myself on that point; but I do know that they are in some cases dug as deep as six feet, in some, three feet, and in others no pit at all is dug and the fecal matter runs broadcast over the ground. If these disgusting cess-pools were not, as unfortunately they mostly are, in close proximity to wells, their presence would, perhaps, be simply an annoyance to the nose rather than a standing menace to the health of the people. It has been facetiously said that a well is a place full of poetic associations and the drippings of neighboring cess-pools. It is to be feared that too many of the wells of this city are a reflex of that definition, minus the poetic associations. But while there is reason to suspect that the contamination of the soil and well-water is widespread, there are wells in the city outside of the area of absorption of household wastes and other polluting influences.

The absorptive capacity of the soil is quite varied throughout the city. Hard clay lies below the alluvial surface to a considerable extent. This condition, no doubt, hinders the percolation of foul liquids; but the porosity of the soil in other parts is so great that wells have been drained dry by the excavation of sewer trenches in the street.

If it were not outside of the range of my subject the natural transition would be to discuss the pathological conditions usually attributed to such impurities, or at least to point out the dangers attending the use of water exposed to the worst of all contaminations, as I have indicated. As soil and water contamination is not made a special subject for the consideration of this convention, and as it is one in which the people of this city are much interested, I hope it will not be lost sight of, since so many gentlemen are present who are qualified to speak with authority on this matter. We have much to learn as regards the sanitary conditions which conduce to health and comfort, and my earnest desire is that our citizens may not gain their knowledge, as many in other cities have, by the hard lines of experience.

The improved condition of the health of this city in general is not all attributable to the sewerage system. The low lands and marshes by which the city is almost girt, which emitted unwholesome vapors to the prejudice of health have been extensively drained and reclaimed, so that the suburbs of the

city are healthful to a marked degree, as compared with former years,—the result wholly of drainage and cultivation.

The surface drainage done under the first county drain law which had any marked effect on the sanitary condition of the city, antedates the adoption of the sewerage plans. One of the first drains laid and constructed under the provisions of that act was on the east boundary of the city, and from it the system was extended in all of its ramifications until it reached the remotest bounds of the county. The ditch referred to and known here as the "city line ditch" has always been a prime necessity in our city drainage system, giving us, until within a year or two, absolutely the only outlet for street drainage, extending as far as half a mile west of it. In 1878 it was deepened and otherwise enlarged, prior to which it was a source of trouble in times of unusually heavy rains, by the overflow extending as far as the sewered districts. The large body of water thus brought into the sewers had the effect to gorge them and flood cellars.

The facilities offered by the extension of the sewers for surface drainage have been taken advantage of to the fullest extent. The extension of the mains in some districts has even been anticipated by the extension of subsidiary drains to reach localities depending for surface drainage on the sewers, and in a few cases drains have been laid long distances from public and private buildings to the public sewers.

One of the objects contemplated by our sewerage and drainage plans was to counteract disadvantages of location; the present superficially clean and improved condition of the city, as compared with its original filthiness, and the drainage to a great extent of its water-logged site, are the practical results which have followed therefrom, and, we think, have fully justified the wisdom of the undertaking.

The benefits which have resulted from the sewerage and drainage of this city are included within the area bounded south by Brewster street, west by Saginaw river, and north and east by the city's boundary. Plans of sewerage were made and registered for the south part of the city several years ago, but so far no sewers have been built there. A bayou which runs almost through the entire city remains, in the south part, in its natural state. Attempts have been made at different times to drain this, resulting only in reaching the plans recommended by the engineers. The condition of this is not, however, as bad as it might be, owing to the influx of fresh water from the river in times of freshets, and its efflux, with the added drainage of a large area of land to the west of it, this inflow and outflow having a tendency to keep it clean.

The discussion of this paper was opened by C. S. Breckenridge, civil engineer of East Saginaw, as follows:

*Mr. Chairman, Ladies and Gentlemen:* The learned gentlemen who have preceded me in these sanitary conventions have in their several papers and discussions so thoroughly exhausted the subject of "Sewers" and "Sewage" both as to their sanitary and general relations, that I find but little left for me to contribute on the subject. I shall therefore confine myself to a few brief remarks and suggestions relative to our local sewerage system.

The projectors and founders of this beautiful and thriving city must have been endowed with a fair share of the wonderful pluck and energy so characteristic of most of our western pioneers.

Thirty years ago, or a little more than one generation, what now constitutes the business center of the metropolis of the Saginaws, nothing met the eye of these live, energetic pioneers, but a long stretch of stagnant "bayou" on the one side, and a sluggish river whose banks were hardly discernable during the spring floods, on the other. These obstacles did not discourage them, but only served to arouse fresh energy and determination. The obnoxious "bayou" was filled up, streets laid out, graded, and otherwise improved, and finally an excellent plan of sewers adopted. They were extremely fortunate in having at their command the services of intelligent and com-

petent men to develop and faithfully carry out this plan, and how well they discharged the trust confided to them is made evident by the good results of their efforts which we are enjoying to-day. I can cheerfully say, that, considering the flat and low elevation above the river, no city within my knowledge can boast of a more perfect and satisfactory working system of sewers than East Saginaw.

There are, however, some sanitary defects, common, no doubt, to all other cities similarly situated, which should be remedied if possible. Sewers, while they may be a necessary adjunct to our comfort and afford facilities for the enjoyment of many conveniences both at home and in your places of business which could not otherwise be had, yet, unless proper sanitary precautions are taken, they may prove a curse, a silent, lurking enemy, awaiting every opportunity to steal into the household and rob you and your families of that which is most precious—health and its consequent happiness.

Being a common receptacle for all manner of vegetable and animal filth in various stages of decomposition, the most foul and poisonous gases are constantly being generated, which from their lightness as compared with atmospheric air naturally seek escape at the upper or more elevated outlets (or rather inlet to the sewer).

Dr. Hamilton, in a recent communication to the health authorities of New York city, said that the three great factors of health are, light, pure air, and good sewers. He congratulated them that nature, while furnishing the two first complete, had also provided an excellent outlet for the latter in the shape of two large rivers far below the general elevation of the city.

We are not so fortunate in this respect, for, in the lower business portion of the city, the cellars are filled to the window gratings during the spring freshets by the back-water from the river. This in itself, aside from the temporary inconvenience, would not be so serious were it not for the fact that there being no cessation in the use of the sewers during this time, these cellars through their connections must necessarily become the receptacle of sewage, or such part of it as remains for any time in suspension. When the flood recedes, it is easy to conjecture what kind of sediment is left behind to poison the surrounding atmosphere and breed disease, perhaps pestilence. In order to remedy this evil, parties making connections with sewers in such localities should be required to contrive some means of closing them during high water, which having receded, they could be opened and the clean surface water would render valuable service in flushing and removing the accumulated sediment.

Another prominent evil, and one that should receive the prompt attention of the health officers, is the too frequent practice of thoughtless or parsimonious citizens of connecting open and untrapped cesspools and privy vaults with our sewers. These pest holes which not only generate their own poison but furnish a convenient outlet for the foul gases of a whole sewer district, are usually far enough removed from the thoughtful proprietor's sensitive nose to cause him but little inconvenience, but his neighbor who has at considerable expense made proper sewer connection must patiently do the smelling and wonder why the neighborhood should be so unhealthy and the doctors visits so frequent.

The proper ventilation of main sewers is a matter of more importance than is usually attached to it. It seems to be sufficient to carefully construct a sewer and as effectually as possible seal up the inlets with traps, while but little thought is given as to what is to become of the pent up gases, part of which must force its way through the traps and defective places in the plumbing, and part will penetrate the porous soil through an occasional open joint, and slowly find its way to the surface.

I have thought of a cheap and simple appliance which I think will furnish the relief required. It is evident that the so-called sewer gas will seek the upper surface of the sewer and make its way to the highest elevations first. At the upper or highest elevation of our sewers, I would tap the top of the sewer with a four or six inch pipe which would be laid to the curb line and then connected with a galvanized iron pipe attached to a pole thirty-five or forty feet high. This would afford a constant current of air from the mouth of the sewer sufficient to carry with it all foul air and noxious gases and deliver them beyond the house top.

There is one more matter to which my attention was recently called, which may prove a very serious obstacle to the utility of our sewers and connections unless some action is taken to remove the cause. I refer to the willow and other "water seeking" shade trees. The willow is perhaps the most dangerous trespasser and should never be allowed to exist on a street where a sewer is laid or in contemplation. The small fibrous roots in their search for moisture, slowly creep through the small seams of the dry earth and will surely find the slightest opening in the joints of pipe, and in an incredibly short period of time we find our sewer or connection almost, if not entirely, obstructed by a tuft of thousands of small fibers created by the one little intruder. These which you see in this box were taken from a single joint of a twelve inch sewer which has only been built six years. This danger is too manifest not to create alarm for the future utility of our splendid system of drainage. Our sewer board have the matter under advisement, and no doubt will recommend to the council such action as the emergency requires.

*Dr. Kedzie:* Prof. R. C. Kedzie said that at the Agricultural College they had had the same

trouble with the Water Elm. The Soft Maple is also a very bad tree in this respect. If sewers are properly flushed there will be no sewer gas, and no need for ventilation of sewers.

## SEWERAGE AND DRAINAGE IN RELATION TO PUBLIC HEALTH.

BY HENRY F. LYSTER, A. M., M. D., PRESIDENT MICHIGAN COLLEGE OF MEDICINE, MEMBER STATE BOARD OF HEALTH.

[Abstract of the Address, by S. G. Higgins, Stenographer.]

The general drainage and cultivation of the surface of the State of Michigan has diminished malarial diseases fully seventy-five per cent since the organization of the State. This matter of drainage does not apply simply to the amount of water in the ground; the contamination of the ground atmosphere must also be considered. The celebrated German physician, Pettenkofer, investigated for thirty years in regard to the ventilation of the soil and the contamination of the air and the water-supply by decomposition in the soil, and reached the conclusion that the air and water are polluted from certain conditions of the soil. He found that certain diseases such as typhoid fever were more prevalent when the ground-water was low in the wells during dry seasons. Still, this question has not been fully solved to the satisfaction of all. So far as we are able to determine, the remedy lies in the cultivation of the soil and the rotation of crops. According to the last United States census, typhoid fever prevails more in malarial districts than in cities, even with their bad sewerage systems. And so it has become settled that malaria or marsh poison is very largely the cause of much of our typhoid fever.

But sometimes there are special causes for typhoid fever. For example, I went to Columbus, Ohio, this fall, to visit a patient,—a little boy of eleven years,—and upon investigation of the premises, the following condition of things was found: The rainfall was caught in a large tank in the attic, and then the surplus rainfall went into a tank in the yard, and this latter tank was connected with the sewer. Through some accident the sewer became stopped up, and the sewage of the house backed up into this pipe leading to the cistern and overflowed into the cistern. The water from this cistern was not used for drinking purposes, but it was used for washing, bathing, washing the teeth, etc. We found a deposit of three or four inches of fecal matter at the bottom of the cistern, and this proved to be the cause of the difficulty.

These poisonous decompositions in the soil remain there indefinitely, and the germs will produce disease when exposed at any time. The difficulty in the sewerage system of East Saginaw could be overcome by having a separate system of smaller pipes for the sewage, leaving the present system to carry away the surplus rainfall. The small pipes could be conducted to a larger pipe running some distance down the river to a basin, where the sewage could be pumped out and used for manure. A similar system has lately been adopted in the city of Memphis, where it has been a great success. One great objection to allowing the sewage to be deposited in the river is that it forms islands of foul matter near the mouth of the sewer, which are stirred up by every passing vessel.

In the construction of sewers in dwelling houses simplicity should be the prevailing rule. One of the latest improvements is to have all the connections

in one part of the house, and it is better if a small addition is built on for this purpose. The plan of having sewer connections all over the house is fast passing out of style. The very best plumbers should be employed, and no attempt towards cheapness should be made in this part of the construction of a home.

At the conclusion of the address by Dr. Lyster, the sewer system of Pullman, Ill., was discussed at some length. The value of clay as a filter to keep impurities from wells was dwelt upon with a variety of views. Dr. Baker thought the clay was no protection where the source of contamination was above the well, even if removed some distance, because the top soil would carry the impure water over the clay for a long distance, even where the fall was slight. Dr. Tyler, of Bay City, expressed similar views, relating some of his own experiences in that regard. Dr. Kedzie thought if the clay was the deep, thick stratum of blue clay, which had no seams in it, it was a good protection; but if it was the ordinary clay, filled with seams, there was no protection, as the impregnated water would find its way through the seams.

The convention then adjourned until 7:30 P. M.

## THE WATER-SUPPLY OF EAST SAGINAW.

BY C. H. FAMES, M. D., OF EAST SAGINAW.

The purity of the drinking water of any city is, from a sanitary standpoint, a subject of paramount importance to its residents. A considerable number of diseases are contracted and spread through the medium of drinking-water, and this applies more especially to well-water than to hydrant water. The well-water supply of this city is in the main good and pure during the dry season of the year. There are no deleterious salts found in the water of any number of the wells in this vicinity. The depth of the wells here varies from ten to twenty-five feet, and the soil is mainly clay.

The chief sources of contamination are imperfect drainage and the access of surface-water. The ground is so flat and so near the level of the river, in a large part of the city, that it is difficult or impossible to obtain good drainage during a large portion of the year. During the winter months many people throw their slops and kitchen refuse on the frozen ground in the most convenient place, and this is too liable to be near the well. When the snow melts, or during rainy weather, this becomes a serious source of contamination to wells that are not properly constructed as regards the ingress of surface-water. During the spring of every year, a nondescript form of fever prevails in this city, due undoubtedly to this cause. The fever somewhat resembles ague, and is not noticeable among the class of people whose hygienic surroundings as regards drainage and water supply are good.

My subject has a special importance at the present time, because of the prevalence of typhoid fever in the city. It is a pretty well established fact that the most common source of infection in typhoid fever is through the medium of drinking-water. This applies more especially to water obtained from wells than to hydrant water. All of our best medical authorities agree on this point in relation to the prevention of the spread of this disease. Dr. Flint in his work on practice says: "Typhoid fever is prevented by proper protection against the use of drinking-water polluted with human excrement, and against emanations from waste pipes, drains, cess-pools, etc. \* \* \* Drinking-water should be boiled if there be any ground for suspecting its purity. In order to prevent the diffusion of the disease, the slops from the sick-room should be buried remote from the well, so as to avoid the possibility of their infecting either the water or the atmosphere."

Good wells can be obtained in almost any part of the city, free from the dangers of contamination by surface water, with small additional expense, in the following manner: The brick or stone work should be carried at least a foot above the surface of the ground and cemented on the inner surface to the water level; then dig a trench—say a foot wide and six or eight feet deep—around the well, and pack this firmly with gravel or clay. If the soil is loose, clay would probably answer a better purpose than gravel, as gravel is simply a mechanical filter, and clay is both mechanical and chemical.

There are a few artesian wells in the city which yield an abundant supply of pure water, and I believe that an inexhaustible supply of such water can be obtained for the city by a properly constructed well reaching to this vein of water.

In the present state of our water supply, it is advisable that both hydrant and well-water, to be used for drinking purposes, should be filtered.

Perhaps the most important point in connection with my subject is the proper separation of drains from wells. A well may be said to drain an inverted cone, the base of which is variable, and may be roughly estimated as having a diameter equal to three or four times the depth of the well, so that for a well fifteen feet deep the drain should be at least thirty feet distant from it, and no refuse matter should be deposited on the ground within that radius.

Prof. R. C. Kedzie, M. D., of the Michigan Agricultural College, ex-President of the State Board of Health, and ex-President of the American Public Health Association, then gave the following address:

## A TALK ON WATER-SUPPLY.

BY PROF. R. C. KEDZIE, M. D., OF MICHIGAN STATE AGRICULTURAL COLLEGE.

The selection of the water-supply of a city is literally a matter of *vital* importance. Its influence is not confined to the present time or the passing generation. For bane or for blessing such a choice casts a long shadow down the corridors of time. It will enter as a component part into the conditions of living, not only of the citizens who throng your streets to-day, but also of the millions that follow them in the endless generations of the future.

Choose wisely, choose soberly, but choose for all time! because a water system once adopted and carried into effect becomes a part of your social constitution, and like other constitutions it will require a heavy majority to secure its amendment. It is like laying the foundation of the family, where wise choice is better than subsequent divorce. The prevention of evil is ever easier than its cure.

Few things command our attention so little when possessed, but whose want is so keenly felt, as water. The symbol of purity and the minister of cleansing, it is a primary necessity for all forms of life. "When the poor and needy seek water and there is none, and their tongue faileth for thirst," then Omnipotence is stirred to relieve their misery: "I will open rivers in high places, and fountains in the midst of the valleys: I will make the wilderness a pool of water, and the dry land springs of water."

### PURE WATER.

For this ministry of life pure water is demanded. Yet absolutely pure water may be said to be an ideal only: it is never found in nature, and is very

difficult to form by art. In consequence of the strong solvent power of water, all soil-water contains mineral matter in solution, besides a number of gases. Even the purest rainwater and distilled water contain oxygen, nitrogen, and carbonic acid in solution, and but for these dissolved gases would be nauseous if not absolutely emetic in property.

In speaking of pure water we do not refer to chemical purity, an impossibility in practice, but to sanitary purity—the freedom from every material injurious to the animal system in any quantity, and the absence of excessive quantity of substances harmless in themselves when present in moderate amount. The water-supply for a city contemplates a variety of uses; for potable and culinary use, for bath and laundry, to extinguish fires, water streets and lawns, and even for manufacturing purposes. It must therefore be exhaustless in supply, free from organic materials which will be a direct cause of disease or increase its virulence, and must be reasonably free from mineral matter which will impair its value for the bath or laundry. Its exemption from *contamination in the future*, as the city extends or the country is cleared up and brought under cultivation, is an important factor in determining its value. The sources of water-supply must be above suspicion not only at the present time but for all time to come.

The presence of even a small amount of decomposing organic matter containing nitrogen and phosphorus—what might be called *sanitary filth*—would be sufficient to condemn any water for domestic use. Its immunity from sanitary filth in the future must be assured before it can safely be selected and adopted.

#### MINERAL MATTER.

The absence of mineral matter from water is claimed to be a condition of great importance. The primary source of all potable and culinary water is the rain; as it descends from the clouds it is nearly free from mineral matter save what was suspended in the air in the form of dust. But when the rain-water comes in contact with the soil, to re-appear in lake, river, spring, or well, it immediately dissolves more or less of the constituents of the soil, and then holds in solution the salts of lime, magnesia, soda, potash, etc., and thus acquires a mineral character not belonging to rainwater before it comes in contact with the ground. Some writers attribute very deleterious qualities to water containing mineral matter, claiming that it causes dyspepsia, intestinal irritation, besides many obscure diseases, such as goitre. When we reflect that these minerals are present in the food of all animals, and that even milk contains them in some abundance, it is difficult to believe that their presence in small quantity in water will be a potent factor of disease. The Chinese claim that water containing a little carbonate of lime is better for making tea than soft water, and the city of Paris is supplied with water from the chalk formation in preference to softer water found nearer the city. I see no reason why five to ten grains of carbonate of lime, and one or two grains of alkaline chlorides should be considered good ground for rejecting a water for potable and culinary use. We can hardly look for soil water with less mineral matter in an alluvial soil, but water of greater purity may be found where the surface is made up of granite rocks.

But a large amount of these mineral matters in water is very objectionable, both from their disturbance on the digestive apparatus, and on account of their injurious influence in bath and laundry, or wherever soap is used. All of these salts (except the alkaline) decompose soap, forming an insoluble lime salt (or

curd), and such waters are "hard" from this cause. Besides the loss of soap from this cause, there is the disagreeable sensation of a salvy, sticky substance adhering to the person or clothing until removed by excess of soap or brisk use of towel and bath brush.

The alkaline chlorides do not decompose soap, as do the lime and magnesia salts, but they prevent the complete solution of soap, and when present in considerable quantity they cause the soap to separate as a curd or insoluble soap.

All the soluble chlorides cause the iron service pipes to rust and corrode, and if lead or zinc is used these metals are acted on by the chlorides, and poisonous lead or zinc salts are formed and remain in the water. For these reasons the alkaline chlorides, even in moderate amount and known to be of mineral origin, are quite objectionable, but when of animal origin, indicating sewage contamination, they are sufficient to cause the rejection of any water.

#### SOURCE OF WATER-SUPPLY.

The source from which a city shall be supplied with water becomes a matter of great importance. Shall you get it from lake? river? well? Lake Huron—that vast unsalted sea of crystalline purity—lies too far away. Shall it be from surface wells with the accumulated soakage of all the surface impurity? Dr. Baker has told you of the relations of low water and high typhoid; that in the nicely poised scales of life when the water-line descends at the same time, the other scale pan flies upward with increase of typhoid fever. This is a consideration that literally comes home to us all. When fever rises as the water-line of the soil falls, you will conclude that if "truth lies in a well," safety does not.

Your mind then turns to the dashing mountain torrents, and you picture to yourselves health and safety in the hillside streams and rivers rushing with music and laughter from the mountain towards the sea. Nothing could be more picturesque or farther removed from the very thought of contamination. Yet the daily press is filled with appalling accounts of a mysterious and fatal disease prevailing in the mountains of Virginia and Kentucky. The dead are too numerous to receive decent burial at the hands of the well, to say nothing of tender care and nursing of the sick. Hundreds have died and thousands are still sick.

This disease is said to be caused by drinking the water from the mountain streams, which have dwindled to murky threads of liquid filth, with occasional pools of poisonous water, dealing out death by the bucketful to the wretched inhabitants. This condition comes from the protracted drought, no abundant rain having fallen in that region for several months until within a few days. Our picturesque and poetic mountain torrent has become a concentrated extract of filth. Mountain stream and silent well alike become sources of disease unless they are purified and revived by the outpouring of the benediction of the sky in the abundant rain.

It would seem that in those distant mountain fastnesses, so close to the heart of nature, we might feel ourselves safe from the polluting touch of man—that pampered civilization must leave the rustic inhabitants in the security of primitive society, and the diseases belonging to the civilized state would be left at a safe distance. Yet the nursling of the hills is no purer than the festering well on the plains. The same danger lurks in mountain fastness as in crowded city. Nature seems to repeat the question of Hamlet's unhappy uncle:

"Is there not rain enough in the sweet heavens]  
To wash away my sin?"

And the prosaic reply comes back from the mountain sides of Virginia and Kentucky, "Not in dry weather!"

Now, if we cannot tap the lake, must not use the wells, and are shut off from the streams, you will ask, Where shall we go. You will think it is a revised edition of the old doggerel:

"You can and you can't,  
You shall and you shan't,  
You will and you won't,  
And you'll be killed if you don't."

I am afraid that you will conclude that the unsafest place to go for peace of body or rest of soul is a sanitary convention, and you will fall back in discouragement and say, "We'll take our germs and bacteria as they come, live while we may, die when we must, go to heaven if we can, or turn to that other place where orthodox disinfectants will destroy germs of every kind." My friend, if that is the road you travel, you may meet with something worse than bacteria and bad water!

The sanitary reformer is in little danger of the accusation of "prophesying smooth things." Brooding over these sources of danger the possible becomes probable, the probable becomes certain, while the healing touch and the conservative ministries of gentle nature are forgotten, and we appear like boding prophets of evil. We would not excite useless alarm, nor hold out a false promise of security. We want to place before you the truth, for it is as true in sanitation as it is in theology, "the truth shall make you free."

In the discussion of the subject of the water supply of East Saginaw, let us come down from the clouds; for it is evident that the rain directly can never afford a satisfactory and sufficient supply of water for your city. You must then derive your supply from soil-water in some form. Let us then look the ground over carefully, and see what you have and what other sources are open.

#### PRESENT SYSTEM.

You have water-works a few miles up Saginaw river, taking water from the river a little below the confluence of the Tittabawassee and the Shiawassee. This water is taken at a point above the outlet of the sewers of both east Saginaw and Saginaw City, and would thus seem to be safe from sewage, for it is supposed to be the first and main business of a river to flow down stream. If the inlet pipe of your water-works was placed below or among the sewer mouths, you would condemn the system by a unanimous verdict without the jury leaving their seat. I know some of you want to tell me what your sister Saginaw City does, but we are not discussing Saginaw City just now, and the only argument adequate for her case is to hold your nose! Wisdom comes from the east, and East Saginaw has wisely rejected sewage as a source of water. You seem to be safe, for the attraction of gravitation is on your side, and gravity never takes a vacation during the heated term or for the holidays. The fact that water runs down hill is in your favor. But does it always? A short way up one of the affluents of the Saginaw I am told that there is a marshy lake covering nearly 100 square miles, and when the wind blows strongly up stream the contents of Saginaw river are carried up stream—the waters overflowing into this lake, and thus the sewage of all the cities on the river is carried to and past your water-works, and both the upper flow and the reflux tide may give you your sewage water at times, gravity to the contrary notwithstanding.

Once more, these streams which feed the Saginaw are the water-beds of millions of saw-logs, lying in store for the use of the saw-mills. These logs

have parted with their bark which lies in the bottom and along the banks undergoing slow decay. This is reinforced by driftwood of every kind, infesting the streams in their whole length. The banks for miles are only marsh, and the lake is a flag and rush swamp rather than a lake. Yet these are your reserve forces from which are drawn the active troops for the daily battle of life. Would you stoop down and drink from these slimy marshes? But how is the water made any better by forcing the water by a steam pump through long lines of pipe, to be finally drawn off through a faucet? It is the same water still, essentially unchanged in properties. I have heard of a housewife who reproved her dog for thrusting his dirty nose into a pan of milk: "You nasty dog! Now I have got to strain that milk over again." How much is your method better than hers?

This for the present; how about the future? What will be the condition of the water in Saginaw river when the Saginaws have reached their possible limit of growth, and the banks of these streams are lined with vast manufactories of every kind to contribute to the defilement of these waters? No civic control is possible to preserve these streams in their present condition without hampering the expansion of the manufacturing interests of both the Saginaws, and when the conflict comes between business and health, you may safely count that business will win the day.

While the amount of organic matter in your river water is a valid objection, and this is capable of indefinite reproduction from marsh and fen which line its borders and form its basin, it is not the only objection. In springtide when the melting snow of the valley adds a vast body of soft water to the river, the water is said to be soft and fit for bath and laundry. But when the snow-flood ceases, the water becomes hard, and at times of low water, the river water becomes excessively hard. One possible explanation of the cause of this extreme hardness I will allude to when I speak of the subterranean or artesian water-supply of Saginaw.

#### THE LAST RESORT.

We have only one more source from which East Saginaw can obtain her supply, and that is "the waters under the earth," or the artesian supply of the valley. Saginaw valley is a bed of strong and impervious clay, extending down to some ninety feet, where it rests upon a bed of sand and gravel of varying depth, and below which is the rock. The clay formation, as we proceed north and west becomes continually thinner, till it disappears entirely in forty-five to fifty miles, and the sand which here underlies the clay becomes there the surface soil. The surface of the country is there some three hundred feet higher than Saginaw Bay. The rain which falls on this sandy soil sinks rapidly till it reaches an impervious layer of rock or clay, and then flows off sideways to lower beds under the overlaying impervious clay and above the impervious rocks beneath, through the pervious layer of sand and gravel. When this covering of hard-pan and clay is pierced, the water rises with great force from the pressure of the back water two hundred or more feet higher, and thus the water comes nearly to the surface at Saginaw, or completely overflows.

[The various artesian wells in and around East Saginaw, and the results of an examination of their waters, were then described at length.]

Here is then a water supply covered by the impenetrable shield of nature for fifty miles, derived from the open country, free from marsh and decomposing organic matter, and purified by filtration through fifty miles of pervious sub-

soil. No reasonable probability exists of its contamination at its source, on its way to the valley, or after its entrance into East Saginaw.

We might expect such water to be organically pure, and forever screened from contamination. From what I hear of this artesian well water, it would seem that the supply is inexhaustible.

But while this water has been protected from organic defilement, it has taken up a large amount of mineral matter, and the water is excessively hard. All waters I have yet examined from this source are too highly charged with mineral matter to be fit for city water-works. But they show great variation, and possibly by a happy selection some point might be found that would give a water safe, exhaustless, and secure from present or future contamination.

[Many samples of water, gathered in the vicinity of East Saginaw, were here exhibited before the convention, and tested for various impurities].

These waters may find their way as submerged springs flowing into the Saginaw river in times of low water, and this explains the excessive hardness found in times of low water.

These closely guarded waters of your deeper soil may prove to be your best supply, if the right point is selected for tapping them. Who is the Moses with rod of authority and power who shall smite the rock and cause the waters to flow for your use?

Then followed general discussion of papers read, and the experiments by Dr. Kedzie with water from artesian wells in the city, and near the city. The Doctor expressed the view that freezing impure water, such as that in the Saginaw river, did not render it pure and fit to drink. The only case where freezing could have a purifying effect was where the water was running rapidly, and where the impurities could be washed away while the water was freezing.

A vote was moved, and carried unanimously, returning thanks to the State Board of Health for holding the convention in this city, and to all who had contributed papers or addresses.

Dr. Baker, on behalf of the State Board of Health, moved that the thanks of the convention be extended to the President, Secretary, and Local Committee for services, to the citizens for their attendance and interest, and to the press for their able and full reports. The motion was carried and the convention adjourned without date.

HARRIET V. BROOKS, *Secretary.*

